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THE PRESENCE AND IMPLICATION OF FOREIGN ORGANISMS IN
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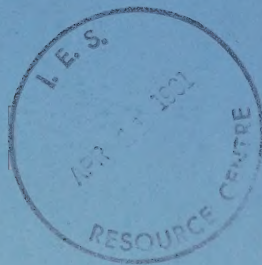
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THE PRESENCE AND IMPLICATION OF FOREIGN ORGANISMS
IN SHIP BALLAST WATERS
DISCHARGED INTO THE GREAT LAKES
- VOLUME 2 -

Prepared by
BIO-ENVIRONMENTAL SERVICES LTD.

for
THE WATER POLLUTION CONTROL DIRECTORATE
ENVIRONMENTAL PROTECTION SERVICE
ENVIRONMENT CANADA

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TABLE 1

VESSEL CHARACTERISTICS

Ship No.	Ship Name	Official No.	Gross Tonnage	Ballast Capacity (mt)	Agency	Last Port	Ballast Origin
1	Parthenon	6695	10,209	5,770	Barber Steamships	Leith (Scotland)	Leith
2	Zabrze Gdymia	1534	6,581	749	McLean Kennedy	Bremen (West Germany)	Les Escoumins (St. Lawrence)
3	Summer Dreams	367023	10,444	4,900	March Shipping	Tarragona (Spain)	Tarragona
4	Ogden Clipper	1743	14,756	9,798	McLean Kennedy	*Batumi (Russia)	Atlantic Coast Portugal
5	Fotini D.E.	4976	7,168	6,000	Colley Motorship	Coatzacoalcos (Mexico)	Mexican Gulf
6	Eastern Countess	8591	15,581	3,712	Lillis Marine	Philadelphia, Pennsylvania	Philadelphia
7	Glafki	2020	15,899	9,792	Kerr Steamship	Venice (Italy)	Venice
8	Derby	P35L	7,624	2,936	Colley Motorship	Lisbon (Portugal)	Lisbon
9	Murmen	M-29720	1,978.44	4 tanks	March Shipping	Santiago (Cuba)	Santiago
10	Mina	8540-3079	11,869.59	9,611	Shipping Limited	Liverpool (England)	Irish Sea
11	Mount Pleasant	4466	9,538	4,716.8	Colley Motorship	Norfolk, Virginia	Norfolk
12	Lake Aniara	5002156	12,757.74	600	Colley Motorship	La Romana (Dominican Republic)	La Romana
13	Vishva Pallav	1846	12,809.98	4,281	March Shipping	Sunderland (England)	Atlantic Coast British Isles
14	Federal St. Clair	5975	16,069	8,040	Federal Commerce	Saint John, N.B.	Saint John
15	Rocknes	365992	3,644.25	1,700	Braemar Shipping	Caen (France)	Caen



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TABLE 1 Cont'd

VESSEL CHARACTERISTICS

Ship No.	Ship Name	Official No.	Gross Tonnage	Ballast Capacity (mt)	Agency	Last Port	Ballast Origin
16	Split	15467	7,976	700	Robert Reford Inc.	Cadiz (Spain)	Atlantic Coast Spain
17	Unterturkheim Bremen	4252	9,864	4,500	March Shipping	Cagliari, Sardinia	Mediterranean Sea
18	Ocean Glory	2829	14,383.66	7,000	Shipping Limited	Baltimore, Maryland	Baltimore
19	Kapodistrias	4402	16,720	12,042	Kerr Steamship	Rotterdam (Holland)	Trois-Rivieres
20	Common Venture	5346	15,588	9,760	Scandia Shipping	Immingham (England)	Immingham and Atlantic Ocean
21	Spanterza	1232	15,821	8,248	Beam Shipping	Ravenna (Italy)	Adriatic Sea near Ravenna
22	Alkaïos	5615	11,284.68	6,000	Colley Motorship	Santiago (Cuba)	Caribbean Sea
23	Euro-Princess	376023	15,886.4	7,564	Clarke Agencies	Birkenhead (England)	Birkenhead
24	Neptune Tourmaline	380628	9,676	3,502	Protos Shipping	Delfzijl (Holland)	Delfzijl
25	Drava	332	14,711.71	11,000	Colley Motorship	Hamburg (Germany)	North Sea
26	Maratha Envoy	332511	16,756	1,600	Colley Motorship	Rotterdam (Holland)	North Sea
27	Lujua	765	15,493	13,603	Kerr Steamship	Sagunto (Spain)	Mediterranean Sea
28	Forum Grace	7676	15,841	7,764	March Shipping	Riga (U.S.S.R.)	Baltic Sea and Gulf of Riga
29	Captain Panagos	4309	16,465	7,112		Birkenhead (England)	Atlantic Coast British Isles
30	Stolt Castle	4564	11,240	4,500	Colley Motorship	Port Jerome (France)	English Channel

TABLE 1 Cont'd

VESSEL CHARACTERISTICS

Ship No.	Ship Name	Official No.	Gross Tonnage	Ballast Capacity (mt)	Agency	Last Port	Ballast Origin
31	Orion	6563	14,806		March Shipping	Leningrad (Russia)	Leningrad
32	Peter L.	4436	13,549	9,925	March Shipping	Klaipeda (Russia)	Klaipeda
33	Mathilde	9682	16,187	8,473	Bremar Shipping	Barcelona (Spain)	Barcelona
34	Federal Danube	ZK295	22,639	16,293	Federal Commerce	Antwerp (Belgium)	Antwerp
35	Demetrios	4231	10,794.12	5,150	March Shipping	Mostaganem (Algeria)	Mostaganem
36	Ziemia Opolska	110838	15,667	7,696	Scandia Shipping	Dunkirk (France)	Dunkirk and North Sea
37	Dinara	2/74	15,398.21	15,000	Cast	Gibraltar	Adriatic Sea (20 nm. off Yugoslavia)
38	Netuno	10328	10,417	1,200	Shipping Ltd.	New York, N.Y.	Santos (Brazil)
39	Monte Zapola	7277	15,490	11,300	B.&K. Shipping	Bilbao (Spain)	Bilbao
40	Angeles Seraphin	-	10,625	-	Montreal Shipping	Jidda (Red Sea)	Suez Canal (near discharge of Nile River)
41	Kraigher B.	6/1-1973	14,700	11,286.3	Robert Reford	Marseille (France)	Mediterranean Sea (near Marseille)
42	Castellblanch	190	17,354.9	13,939.1	Colley Motorship	Rotterdam (Holland)	Rotterdam
43	Euterpe	12503	5,977	2,679 ₁	March Shipping	Puerto Capello (Venezuela)	Caribbean Sea
44	Sophia C.	7455	15,696	9,530	March Shipping	Batumi (U.S.S.R.)	Black Sea (off coast of

TABLE 1 Cont'd

VESSEL CHARACTERISTICS

Ship No.	Ship Name	Official No.	Gross Tonnage	Ballast Capacity (mt)	Agency	Last Port	Ballast Origin
45	Pandora	4428	10,779.1	4,800	Scandia Shipping	Augusta(Sicily)	Mediterranean Sea
46	Federal Shelde	16097	21,965.1	14,860	Federal Commerce	Rotterdam (Holland)	Trois Rivieres (Quebec)
47	Stinnes Zephir	344214	4,791.1	1,450	Protos Shipping	Alexandria (Egypt)	Alexandria
48	Vasilis	395	16,432.3	8,500	Montreal Shipping	Inkoo (Finland)	Inkoo and Baltic Sea
49	Jesus Menendez	576	10,056	2,258.9	Colley Motorship	Santiago (Cuba)	St. Lawrence
50	Jiguani	455	9,390.2	4,000	Colley Motorship	Saint John(N.B.)	Saint John(N.B.)
51	Kefalonia Wind	7402	13,906.92	8,500	Marilines	Cuba	100 nm. off coast of Cuba
52	Euro Princess	376023	15,886.4	7,564	Clarke	Delfzijl (Holland)	Delfzijl
53	Baltic Skou	D2512	16,650.43	13,181.	Montreal Shipping	Antwerp (Belgium)	Antwerp
54	Zirje	288	17,996	10,072	Cast	Split (Yugoslavia)	Adriatic Sea
55	Marko Marulic	1031	8,852	2,500	Robert Reford	Calais (France)	Atlantic O.(200 nm. from Calais)

TABLE 2

BALLAST WATER CHARACTERISTICS

Ship No.	Ship Name	Ballast Origin	pH	Oxygen (ppm)	Temp. (°C)	Salinity (0/0)	Sampling Site	Date Sampled
1	Parthenon	Leith (Scotland)	6.8	13.4	22.0	2.95	Manhole	Aug. 25
2	Zabrze Ogynia	Les Escoumins (St. Lawrence)	7.6	9.2	26.0	0.40	Pump	Aug. 26
3	Summer Dreams	Tarragona (Spain)	8.1	9.2	22.0	3.50	Manhole	Aug. 26
4	Ogden Clipper	Atlantic Coast Portugal	7.7	11.0	19.0	3.40	Manhole	Aug. 28
5	Fotini D.E.	Mexican Gulf	7.3	6.4	26.0	3.20	Manhole	Aug. 28
6	Eastern Countess	Philadelphia Pennsylvania	7.7	11.7	25.0	1.10	Manhole	Aug. 28
7	Glafki	Venice (Italy)	6.9	6.0	21.0	2.80	Pump	Sept. 3
8	Derby	Lisbon (Portugal)	7.5	12.4	23.0	2.90	Manhole	Sept. 3
9	Murmen	Santiago (Cuba)	6.9	3.6	35.0	2.10	Pump	Sept. 8
10	Mina	Irish Sea		11.8	16.0	3.10	Manhole	Sept. 9
11	Mount Pleasant	Norfolk, Virginia		5.5	19.0	2.00	Pump	Sept. 10
12	Lake Aniara	La Romana (Dominican Republic)	5.4	2.2	22.5	3.20	Manhole	Sept. 11
13	Vishva Pallav	Atlantic Coast British Isles	7.7	9.2	17.0	3.00	Manhole	Sept. 11
14	Federal St. Clair	Saint John (N.B.)	6.7	4.5	14.0	2.90	Manhole	Sept. 15
15	Rocknes	Caen (France)	7.0	10.3	17.0	1.30	Manhole	Sept. 15
16	Split	Atlantic Coast Spain	6.7	5.6	17.5	3.40	Pump	Sept. 15
17	Unterturkheim Bremen	Mediterranean Sea	7.4	7.6	17.5	0.80	Manhole	Sept. 15

TABLE 2 Cont'd

BALLAST WATER CHARACTERISTICS

Ship No.	Ship Name	Ballast Origin	pH	Oxygen (ppm)	Temp. (°C)	Salinity (0/0)	Sampling Site	Date Sampled
18	Ocean Glory	Baltimore, Maryland	7.4	7.6	17.5	0.80	Manhole	Sept. 16
19	Kapodistrias	Trois Rivières (Que.)	6.8	6.2	16.0	0.85	Pump	Sept. 16
20	Common Venture	Immingham and Atlantic Ocean	7.6	7.2	16.0	3.15	Manhole	Sept. 17
21	Spanterza	Ravenna (Italy)	8.0	4.8	17.1	3.00	Manhole	Sept. 17
22	Alkaios	Near Cuba	7.4	5.3	12.0	2.50	Pump	Sept. 18
23	Euro Princess	Birkenhead (England)	7.8	5.2	12.5	2.50	Pump	Sept. 18
24	Neptune Tourmaline	Delfzijl (Holland)	8.1	6.7	13.0	1.70	Pump	Sept. 22
25	Drava	North Sea	7.5	6.9	13.5	2.00	Manhole	Sept. 22
26	Maratha Envoy	North Sea	6.6	7.3	16.0	0.30	Manhole	Sept. 22
27	Lujua	Mediterranean Sea	7.3	4.3	16.0	3.20	Pump	Sept. 25
28	Forum Grace	Baltic Sea and Gulf of Riga	7.9	3.5	16.5	0.18	Pump	Sept. 25
29	Captain Panagos	Atlantic Coast British Isles	8.1	5.2	12.5	3.05	Pump	Sept. 26
30	Stolt Castle	English Channel	7.6	6.5	12.0	3.05	Manhole	Sept. 26
31	Orion	Leningrad (Russia)	7.1	5.6	5.7	0.00	Manhole	Sept. 29
32	Peter L.	Klaipeda (Russia)	6.0	8.2	10.0	0.70	Pump	Sept. 29
33	Mathilde	Barcelona (Spain)	7.2	6.2	14.0	3.25	Pump	Sept. 30
34	Federal Danube	Antwerp (Belgium)	7.6	3.7	32.0	2.95	Pump	Oct. 2

TABLE 2 Cont'd

BALLAST WATER CHARACTERISTICS

Ship No.	Ship Name	Ballast Origin	pH	Oxygen (ppm)	Temp. (°C)	Salinity (0/0)	Sampling Site	Date Sampled
35	Demetrios	Mostaganem (Algeria)	7.4	7.6	10.0	3.00	Pump	Oct. 3
36	Ziemia Opolska	Dunkirk and North Sea	7.7	8.0	7.0	3.60	Manhole	Oct. 6
37	Dinara	Adriatic Sea (20 nm. off coast of Yugoslavia)	7.6	3.9	23.0	0.10	Pump	Oct. 7
38	Netuno	Santos (Brazil)	7.8	3.5	12.0	0.10	Pump	Oct. 7
39	Monte Zapola	Bilbao (Spain)	7.3	6.3	11.0	2.75	Manhole	Oct. 7
40	Agelos Seraphin	Suez Canal (near discharge of Nile River)	7.3	6.8	15.2	0.05	Pump	Oct. 8
41	Kraigher B.	Mediterranean Sea (near Marseille)	7.2	6.5	14.0	3.21	Manhole	Oct. 14
42	Castellblanch	Rotterdam (Holland)	7.5	3.9	11.0	2.10	Pump	Oct. 14
43	Euterpe	Caribbean Sea	4.2	6.7	24.0	1.83	Pump	Oct. 14
44	Sophia C.	Black Sea (off coast of U.S.S.R.)	6.9	7.4	11.8	1.82	Pump	Oct. 14
45	Pandora	Mediterranean Sea	7.7	8.3	5.6	2.61	Manhole	Oct. 15
46	Federal Shelde	Trois Rivières (Que.)	7.8	8.0	10.0	0.00	Manhole	Oct. 15
47	Stinnes Zephir	Alexandria (Egypt)	7.0	8.1	10.0	3.24	Pump	Oct. 16
48	Vasilis	Inkoo and Baltic Sea	6.8	9.7	5.6	1.37	Pump	Oct. 20
49	Jesus Menendez	St. Lawrence	7.7	8.3	10.0	1.35	Manhole	Oct. 20
50	Jiguani	Saint John(N.B.)	7.6	6.6	9.0	0.88	Manhole	Oct. 20

BALLAST WATER CHARACTERISTICS

TABLE 2 Cont'd

Ship No.	Ship Name	Ballast Origin	pH	Oxygen (ppm)	Temp. (°C)	Salinity (0/0)	Sampling Site	Date Sampled
51	Kefalonia Wind	100 nm. off coast of Cuba	7.4	3.5	11.8	3.14	Manhole	Oct. 20
52	Euro Princess	Delfzinl (Holland)	8.0	9.6	6.5	1.70	Pump	Oct. 21
53	Baltic Skou	Antwerp (Belgium)	7.75	9.7	6.4	0.65	Pump	Oct. 21
54	Zirje	Adriatic Sea	7.6	8.5	10.2	3.13	Pump	Oct. 21
55	Marko Marulic	North Sea (200 nm. from Calais, France)	7.8	8.5	6.3	3.08	Manhole	Oct. 24

TABLE 3

BIO-CHEMICAL ANALYSIS OF BALLAST WATER SAMPLES

SHIP NO.	OIL/GREASE (mg/l)	BODs (mg/l)	CADMIUM (mg/l)	MERCURY (mg/l)	LEAD (mg/l)
1	17	35			
2	57	4			
3	32	9			
4	59	3			
5	34	4			
6	23	4			
7	43	5			
8	76	6			
9	35	1.8			
10	40	1.0			
11	7	1.0			
12	122	670			
13	53	3.3			
14	16	1.8			
15	53	1.1			
16	57	1.3			
17	34	1.0			
18	21	1.2			
19	25	1.2			
20	3	1.7	0.05	0.0003	0.5
21	96	1.1			
22	43	1.6			
23	7	1.0			
24	29	3.0			
25	2	3.6			
26	11	2.2			
27	128	2.7			
28	7	1.2			
29	41	3.5			
30	89	2.3			

TABLE 3 Cont'd

2.

SHIP NO.	OIL/GREASE (mg/l)	BODs (mg/l)	CADMIUM (mg/l)	MERCURY (mg/l)	LEAD (mg/l)
31	13	2.9	0.01	0.0004	0.05
32	21	3.6			
33	65	2.0			
34	141	1.2			
35	61	1.6			
36	69	1.6			
37	81	1.2			
38	77	2.3			
39	74	1.0			
40	53	1.0			
41	60	1.0			
42	52	1.0			
43	41	1.0			
44	56	1.0			
45	58	1.0			
46	10	1.0			
47	74	1.2			
48	35	1.2			
49	27	1.5			
50	22	2.1			
51	49	1.0			
52	54	1.0			
53	67	1.0			
54	18	1.0			
55	112	1.0			

TABLE 4

MICROBIOLOGICAL ANALYSIS OF BALLAST WATER SAMPLES

SHIP NO.	TOTAL COLIFORM (/100ml)	ENTERIC STREPTOCOCCI (/100ml)	<u>VIBRIO SPP.</u>	HEPATITIS VIRUS
1	75	0		
2	4,600	0		
3	0	0		
4	0	0		
5	0	0		
6	1,100	0		
7	3	0		Negative
8	0	0		
9	0	0		
10	0	0		
11	4	0		
12	460	0	Negative	Negative
13	0	0		
14	0	0		
15	0	0		
16	240	21		
17	0	0		
18	2,400	0		
19	0	0		
20	0	4		
21	0	0		Negative
22	3	0		
23	0	0		
24	0	0		
25	460	37		
26	4	0		
27	0	1		
28	93	1		
29	0	0		
30	3	0		

TABLE 4 Cont'd

2.

SHIP NO.	TOTAL COLIFORM (/100ml)	ENTERIC STREPTOCOCCI (/100ml)	<u>VIBRIO</u> <u>SPP.</u>	HEPATITIS VIRUS
31	75	0		
32	23	0		
33	0	0		
34	0	0		
35	0	0	Negative	Negative
36	7	0		
37	460	0	Negative	Negative
38	15	0	Negative	Negative
39	7	0		
40	2,400	0		
41	0	0		
42	2,400	0		
43	0	0		
44	0	0		
45	0	0		
46	1,100	0		
47	0	0		
48	0	0		
49	1,100	0		
50	93	0		
51	0	0		
52	4	0		
53	93	0		
54	0	0		
55	9	0		

TABLE 5

PHYTOPLANKTON SPECIES LIST*

<u>TAXA</u>	<u>OCCURRENCE BY SHIP NUMBER</u>
<u>BACILLARIOPHYCEAE</u>	
Order: Centrales	
Family: Biddulphiaceae	
<i>Belleriochea</i> sp.	42
<i>Biddulphia</i> spp.	7, 25, 34, 42, 50, 53
<i>Ditylium brightwelli</i>	7, 25
[<i>Hydrosera</i> spp.	19, 43
<i>Triceratium</i> spp.	42, 54
Family: Chaetoceraceae	
<i>Chaetoceros</i> spp.	7, 22, 23, 25, 34, 36, 37, 45, 49
Unidentified spp.	22, 38, 44
Family: Coscinodiscaceae	
<i>Actinocyclus</i> spp.	2, 14, 18, 25, 40, 42, 48, 53
<i>Coscinodiscus</i> spp.	2, 5, 7, 10, 16, 18, 19, 22, 23, 24, 25, 32, 33, 34, 35, 37, 39, 40, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 54
<i>Cyclotella</i> spp.	7, 25, 49
<i>Melosira</i> various	37
<i>Melosira</i> spp.	7, 16, 19, 22, 31, 37, 38, 40, 42, 43, 48, 50, 53
<i>Stephanodiscus</i> spp.	22, 42
<i>Thallasiosira</i> spp.	7, 22, 25, 37, 38, 41, 48, 49, 53
Family: Corethronaceae	
<i>Corethron</i> sp.	41
Family: Leptocylindraceae	
<i>Leptocylindricus danicus</i>	37
Family: Rhizosoleniaceae	
<i>Rhizosolenia</i> spp.	7, 25, 37
Disrupted filament (non-branched)	10

TAXA	OCCURRENCE BY SHIP NUMBER
Order: Pennales	
Family: Acanthaceae	
<i>Cocconeis placentula</i>	7, 37, 48, 53
Family: Cymbellaceae	
<i>Cymbella prostrata</i>	49
<i>Cymbella</i> sp.	37
Family: Eunotiaceae	
<i>Eunotia</i> sp.	37
Family: Fragilariaceae	
<i>Asterionella formosa</i>	37
<i>Asterionella</i> spp.	12, 18, 49
<i>Fragilaria crotonensis</i>	7, 37
<i>Fragilaria</i> spp.	7, 16, 18, 22, 37, 38, 39, 40, 42, 46, 48, 49
<i>Hannaea arcus</i>	7
<i>Synedra ulna</i>	7, 37
<i>Synedra</i> spp.	25, 37
<i>Tabellaria fenestra</i>	37
<i>Tabellaria flocculosa</i>	25
<i>Tabellaria</i> spp.	18, 40, 46, 49
<i>Thalassionema</i> sp.	48
Family: Gomphonemaceae	
<i>Gomphonema</i> spp.	25, 37
Family: Naviculaceae	
<i>Diatomella</i> sp.	50
<i>Gyrosigma</i> spp.	7, 13, 40, 49
<i>Navicula</i> spp.	7, 37, 41, 50, 53

TABLE 5 (Cont'd)

3.

<u>TAXA</u>	<u>OCCURRENCE BY SHIP NUMBER</u>
Family: Nitzschiaceae	
<i>Nitzschia sigmoidea</i>	37
<i>Nitzschia</i> spp.	7, 18, 37, 41, 53
Family: Surirellaceae	
<i>Campylodiscus</i> sp.	7, 37, 53
<i>Surirella</i> sp.	37
Unidentified pennate diatom spp.	12, 13, 16, 18, 22, 24, 42, 43, 50

DINOPHYCEAE

Order: Dinokontae

Family: Ceratiaceae	
<i>Ceratium arcticum</i>	49
<i>Ceratium extensum</i>	6, 13, 49
<i>Ceratium furca</i>	18, 35
<i>Ceratium fusus</i>	10, 17, 25, 30, 36, 41
<i>Ceratium hirundinella</i>	2, 7, 18, 46, 49
<i>Ceratium horridum</i>	18
<i>Ceratium lineatum</i>	10, 13
<i>Ceratium longipes</i>	18, 21, 22, 49, 50
<i>Ceratium macroceros</i>	16, 35, 42
<i>Ceratium pentagonum</i>	25, 41
<i>Ceratium tripos</i>	6, 7, 8, 10, 11, 17, 21, 23, 25, 36, 37, 41, 44, 49, 50, 54
<i>Ceratium</i> spp.	5, 6, 22, 34, 38, 43, 51
Family: Gonyaulaceae	
Unidentified sp.	22
Family: Gymnodiniaceae	
Unidentified sp.	18

TAXAOCCURRENCE BY SHIP NUMBER

Family: Peridiniaceae

Peridiniopsis sp. 19*Peridinium depressum* 13, 42*Peridinium* spp. 25, 35, 36, 37, 40, 41, 48, 53

Unidentified spp. 18, 19, 22, 44

Unidentified palmella form 49

DESMOPHYCEAE

Order: Desmomonadales

Family: Procentraceae

Phalacroma sp. 37*Procentrum* spp. 7, 25CHLOROPHYCEAE

Order: Chaetophorales

Family: Aphanochaetaceae

Chaetonemopsis sp. 19

Unidentified sp. 19

Family: Chaetophoraceae

Chaetophora sp. 40*Ctenocladus* sp. 18*Microthamnion*
strictissimum 50*Stigeoclonium* sp. 46, 49

Order: Chlorococcales

Family: Chlorococcaceae

Chlorococcum sp. 18

TAXA	OCCURRENCE BY SHIP NUMBER
Family: Coccomyxaceae	
<i>Elaktothrix</i> sp.	36
Family: Hydrodictyaceae	
<i>Hydrodicton</i> sp.	40
<i>Pediastrum boryanum</i>	9, 18, 19, 32, 46
<i>Pediastrum duplex</i>	2, 6, 7, 11, 16, 18, 19, 38, 40, 43, 46, 49
<i>Pediastrum simplex</i>	2, 6, 7, 14, 16, 18, 19, 20, 37, 40, 42, 43, 46, 47, 49, 50, 51, 54
<i>Pediastrum</i> spp.	2, 17, 18, 19, 40, 46
Family: Aocystaceae	
<i>Ankistrodesmos falcatus</i>	25
<i>Closteriopsis longissima</i>	19
Family: Scenedesmaceae	
<i>Coelastrum cambricum</i>	49
<i>Coelastrum microporum</i>	46, 49
<i>Scenedesmus crassus</i>	18
Order: Cladophorales	
Family: Cladophoraceae	
<i>Cladophora</i> spp.	18, 40, 49, 50, 52
Order: Ulotrichales	
Family: Ulotrichaceae	
<i>Binucleria</i> sp.	9
<i>Geminella</i> sp.	9
<i>Ulothrix</i> spp.	14, 18, 19, 24, 31, 42, 52
Unidentified spp.	24, 26, 32, 40, 49

TAXA	OCCURRENCE BY SHIP NUMBER
Family: Microsporaceae	
<i>Microspora</i> sp.	46
Order: Ulvales	
Family: Ulvaceae	
<i>Schizomeris leibleinii</i>	19
Order: Volvocales	
Family: Chlamydomonadaceae	
Unidentified sp.	40
Family: Phacotaceae	
<i>Pteromonas</i> sp.	43
Order: Zygnematales	
Family: Desmidaceae	
<i>Hyalotheca</i> sp.	2
<i>Staurastrum sebaldi</i>	18, 40, 46, 49
<i>Staurastrum</i> spp.	7, 16, 18, 37, 39, 42, 43
Unidentified sp.	6
Family: Zygnemataceae	
<i>Mougeotia</i> sp.	2, 18, 40, 43, 46, 49, 50, 52
<i>Mougeotiopsis calospora</i>	18, 46, 49
<i>Pleurodiscus</i> sp.	18
<i>Spirogyra</i> spp.	18, 24, 46
<i>Zygnema</i> spp.	6, 18
Unidentified sp.	6
Disrupted filament (non-branched) sp.	16
Unidentified nanofilament (non-branched) spp.	2, 7, 18, 19, 25, 37, 40, 41, 44, 46, 52
Unidentified nanofilament (branched) sp.	7

TAXAOCCURRENCE BY SHIP NUMBEREUGLENOPHYCEAE

Order: Euglenales

Family: Euglenaceae

Euglena spp. 7, 18, 48

Unidentified sp. 35

XANTHOPHYCEAE

Order: Mischococcales

Family: Pleurochloridaceae

Botrydiosis sp. 18

Order: Tribonemales

Family: Tribonemataceae

Tribonema bombycinum 49*Tribonema* spp. 9, 30CHRYSTOPHYCEAEUnidentified flagellate
(colourless) spp.

7, 22, 36, 37, 41, 48, 53

CRYPTOPHYCEAE

Order: Cryptomonadales

Family: Cryptochrysidaceae

Chroomonas spp. 41, 48*Rhodomonas* sp. 37

Family: Cryptomonadaceae

Cryptomonas spp. 7, 18, 25, 36, 37, 41, 48, 53

TAXAOCCURRENCE BY SHIP NUMBERCYANOPHYCEAE

Order: Chroococcales

Family: Chroococcaceae

<i>Agmenellum thermale</i>	42
<i>Anacystis aeruginosa</i>	6, 42
<i>Anacystis marina</i>	42, 49
<i>Anacystis montana</i>	32
<i>Aphanocapsa rivularis</i>	49
<i>Chroococcus</i> spp.	18, 46
<i>Coelosphaerium</i> <i>kuetzingianum</i>	49, 50
<i>Coelosphaerium</i> <i>naegelianum</i>	49
<i>Coelosphaerium</i> sp.	18
<i>Microcystis aeruginosa</i>	18, 19, 40, 46, 49
<i>Microcystis viridis</i>	38
<i>Microcystis</i> sp.	43

Order: Nostocales

Family: Nostocaceae

<i>Anabaena oscillaroides</i>	24, 55
<i>Anabaena</i> spp.	6, 19, 46
<i>Nodularia</i> sp.	6
Unidentified sp.	40

Family: Oscillatoriaaceae

<i>Lyngba</i> spp.	18, 50
<i>Oscillatoria lutea</i>	14, 17, 18, 23
<i>Oscillatoria</i> spp.	6, 9, 18, 31, 46, 49
<i>Spirulina subsala</i>	16, 19, 20, 21, 33, 35, 42, 44
<i>Spirulina</i> spp.	2, 6, 18, 46
Unidentified spp.	7, 18, 25, 46
Unidentified nanofilament (non-branched) spp.	4, 6, 49

<u>TAXA</u>	<u>OCCURRENCE BY SHIP NUMBER</u>
<u>PHAEOPHYCEAE</u>	
Order: Ectocarpales	
Family: Ectocarpaceae	
<i>Ectocarpus</i> sp.	18
Unidentified	8
<u>RHODOPHYCEAE</u>	
Order: Nemalionales	
Family: Chantransiaceae	
<i>Rhodochorton</i> spp.	2, 14, 49
<u>UNIDENTIFIABLE</u>	
Coelastrum-like colony	46
Colacium-like filament	46
Colourless parasitic algae	49
Disrupted filament (branched)	16, 19, 20, 40, 43, 46, 47
Disrupted filament (non-branched)	17, 19, 34
Encrusted filament (non-branched)	9
Encrustation	2
Filamentous nanoplankton (non-branched)	2, 3, 6, 9, 13, 14, 16, 17, 18, 19, 21, 22, 23, 31, 38, 39, 44, 45, 46, 49, 50, 52
Oocystis-like cells	7
Spherical unicellular algae	40

*Prescott, 1970 (order and family)
 Chapman and Chapman, 1973 (class)
 Werner, 1977 (diatoms)

TABLE 6

BIOLOGICAL SIGNIFICANCE KEY OF AQUATIC FLORA

The following letter designations apply to the tables of the potential impact of selected phytoplankton (Tables 7 - 17) (from Palmer, 1977).

- A - Algae are an attached species generally associated with covering and fouling problems.
- C - Algae causing coloration of the water.
- E - Algae common in eutrophic waters producing significant blooms.
- F - Filter screen clogging species.
- I - Indicator species.
- PE - Algae common in polluted estuaries - producing significant blooms or indicating tolerance and/or adaptability.
- PF - Algae common in polluted freshwater - producing significant blooms or indicating tolerance and/or adaptability.
- SP - Algae producing slime.
- T - Algae affecting water quality by taste or odour.
- XF - Toxic algae found in freshwater.
- XM - Toxic algae found in a marine habitat.

TABLE 7

POTENTIAL IMPACT OF SELECTED BACILLARIOPHYTES

<u>Species</u>	<u>Occurrence in Ship Samples</u>	<u>Significance*</u>
<i>Asterionella</i> spp.	12, 18, 49	E, PF, SP,
<i>Asterionella formosa</i>	37	E, F
<i>Chaetoceros decidiens</i>	-	PE
<i>Cocconeis placentula</i>	7, 37, 48, 53	C, PF
<i>Coscinodiscus</i> spp.	2, 5, 7, 10, 16, 18, 19, 22, 23, 24, 25, 32, 33, 34, 35, 37, 39, 40, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 54	PE
<i>Cyclotella</i> spp.	7, 25, 49	E, I, SP
<i>Cyclotella bodanica</i>	-	C
<i>Cyclotella comta</i>	-	T
<i>Cyclotella menegheniana</i>	-	F
<i>Diatoma vulgare</i>	-	F, PF
<i>Fragellaria</i> spp.	7, 16, 18, 22, 37, 38, 39, 40, 42, 46, 48, 49	E, SP
<i>Fragellaria crotonensis</i>	7, 37	E, F
<i>Fragellaria construens</i>	-	T
<i>Gyrosigma</i> spp.	7, 13, 40, 49	E
<i>Gyrosigma attenuatum</i>	-	C
<i>Melosira</i> spp.	7, 16, 19, 22, 31, 37, 38, 40, 42, 43, 48, 50, 53	E
<i>Melosira granulata</i>	-	F, PF
<i>Melosira varians</i>	37	F, PF
<i>Navicula</i> spp.	7, 37, 41, 50, 53	E, I, PE, SP
<i>Navicula exigua</i>	-	C
<i>Navicula graciloides</i>	-	T
<i>Navicula lanceolata</i>	-	F
<i>Nitzschia</i> spp.	7, 18, 37, 41, 53	E, I, SP
<i>Nitzschia sigmoidea</i>	37	PF
<i>Pinnularia</i> spp.	-	SP, C
<i>Rhizosolenia</i> spp.	7, 25, 37	PE
<i>Stephanodiscus</i> spp.	22, 42	E
<i>Stephanodiscus hantzschii</i>	-	F, PF
<i>Staphanodiscus niagare</i>	-	T

TABLE 7 (Cont'd)

<u>Species</u>	<u>Occurrence in Ship Samples</u>	<u>Significance*</u>
<i>Surirella</i> sp.	37	E, SP
<i>Surirella splendida</i>	-	C
<i>Synedra</i> spp.	25, 37	E, I, SP, T
<i>Synedra ulna</i>	7, 37	PF, T
<i>Tabellaria</i> spp.	18, 40, 46, 49	E, F, T
<i>Tabellaria fenestrata</i>	37	F, T
<i>Tabellaria flocculosa</i>	25	F

*See Biological Significance Key (Table 6)

TABLE 8

POTENTIAL IMPACT OF SELECTED DINOPHYTES

<u>Species</u>	<u>Occurrence in Ship Samples</u>	<u>Significance*</u>
<i>Ceratium hirundinella</i>	2, 7, 18, 46, 49	E, F, T, XF**
<i>Glenodinium palustre</i>	-	E, SP, T
<i>Gymnodium</i> spp.	18	PE, SP
<i>Peridinium</i> spp.	25, 35, 36, 37, 40, 41, 48, 53	-
<i>Peridinium cinetum</i>	-	T
<i>Peridinium wisconsinense</i>	-	F

*See Biological Significance Key (Table 6)

**From Nicholls et.al., 1980

TABLE 9

POTENTIAL IMPACT OF SELECTED CHLOROCOCCALES

<u>Species</u>	<u>Occurrence in Ship Samples</u>	<u>Significance*</u>
<i>Ankistrodesmus falcatus</i>	25	PF, SP
<i>Ankistrodesmus</i> spp.	-	E, I, SP
<i>Chlorococcum</i> sp.	18	-
<i>Chlorococcum humicola</i>	-	PF, SP
<i>Coelastrum microporum</i>	46, 49	E, PF
<i>Elaktothrix</i> sp.	36	-
<i>Elaktothrix gelatinosa</i>	-	SP
<i>Pediastrum</i> spp.	2, 17, 18, 19, 40, 46	E, SP
<i>Pediastrum boryanum</i>	9, 18, 19, 32, 46	PF
<i>Scenedesmus crassus</i>	18	-
<i>Scenedesmus abundans</i>	-	T
<i>Scenedesmus dimorphus</i>	-	PF, SP

*See Biological Significance Key (Table 6)

TABLE 10

POTENTIAL IMPACT OF SELECTED ULOTRICHALES

<u>Species</u>	<u>Occurrence in Ship Samples</u>	<u>Significance*</u>
<i>Ulothrix</i> spp.	14, 18, 19, 24, 31, 42, 52	E, SP
<i>Ulothrix aequalis</i>	-	C
<i>Ulothrix variabilis</i>	-	F
<i>Ulothrix zonata</i>	-	A, C, PF
<i>Microspora</i> sp.	46	SP
<i>Microspora amoena</i>	-	A
<i>Sticchococcus</i> spp.	-	SP
<i>Sticchococcus marinus</i>	-	PE

*See Biological Significance Key (Table 6)

TABLE 11

POTENTIAL IMPACT OF SELECTED VOLVOCALES

<u>Species</u>	<u>Significance*</u>
<i>Chlamydomonas</i> sp.	I, PE, SP, T
<i>Eudorina elegans</i>	PF, SP
<i>Pandorina morum</i>	E, I, SP, T
<i>Volvox aureus</i>	E, T
<i>Carteria multifilis</i>	I, PF

*See Biological Significance Key (Table 6)

TABLE 12

POTENTIAL IMPACT OF SELECTED ZYGNEMATALES

<u>Species</u>	<u>Occurrence in Ship Sample</u>	<u>Significance*</u>
<i>Mougeotia</i> spp.	2, 18, 40, 43, 46, 49, 50, 53	A, E
<i>Mougeotia sphaerocarpa</i>	-	F
<i>Zygnema</i> spp.	6, 18	A, SP
<i>Zygnema insigne</i>	-	F
<i>Sirogonium</i> spp.	-	A
<i>Spirogyra</i> spp.	18, 24, 46	A, E, SP
<i>Spirogyra communis</i>	-	PF
<i>Spirogyra majuscula</i>	-	T
<i>Spirogyra porticalis</i>	-	F
<i>Closterium</i> spp.	-	E, I, SP
<i>Closterium acerosum</i>	-	PF
<i>Closterium minoliferum</i>	-	F
<i>Cosmarium</i> spp.	-	E, SP
<i>Cosmarium portianum</i>	-	T
<i>Euastrum oblongum</i>	-	C
<i>Hyalotheca</i> sp.	2	-
<i>Microsterias truncata</i>	-	C
<i>Staurastrum</i> spp.	7, 16, 18, 37, 39, 42, 43	E, SP
<i>Staurastrum paradoxum</i>	-	T
<i>Staurastrum punctulatum</i>	-	C

*See Biological Significance Key (Table 6)

TABLE 13

POTENTIAL IMPACT OF SELECTED EUGLENOPHYTES

<u>Species</u>	<u>Occurrence in Ship Sample</u>	<u>Significance*</u>
<i>Euglena</i> spp.	7, 18, 48	E, I, SP
<i>Euglena acus</i>	-	PF
<i>Trachelomonas crebea</i>	-	F, SP
<i>Phacus longicauda</i>	-	C

*See Biological Significance Key (Table 6)

TABLE 14

POTENTIAL IMPACT OF SELECTED CHRYSOPHYTES

<u>Species</u>	<u>Significance*</u>
<i>Chromulina</i> spp.	SP
<i>Chromulina rosanoffi</i>	C
<i>Dinobryon</i> spp.	SP, T
<i>Dinobryon sertularia</i>	F
<i>Dinobryon stipipatum</i>	C
<i>Synura uvella</i>	PF, T

*See Biological Significance Key (Table 6)

TABLE 15

POTENTIAL IMPACT OF SELECTED CRYPTOPHYTES

<u>Species</u>	<u>Occurrence in Ship Sample</u>	<u>Significance*</u>
<i>Chroomonas</i> spp.	41, 48	PE, SP
<i>Chroomonas nordstettii</i>	-	C
<i>Cryptomonas</i> spp.	7, 18, 25, 36, 37, 41, 48, 53	SP, T
<i>Cryptomonas erosa</i>	-	PF, T
<i>Rhodomonas</i> sp.	37	-
<i>Rhodomonas lacustris</i>	-	C, SP

*See Biological Significance Key (Table 6)

TABLE 16

DISTRIBUTION OF SELECTED CYANOPHYTES*

<u>Species</u>	<u>Distribution</u>
<i>Agmenellum thermale</i>	'In fresh, brackish, and marine waters ... Of worldwide distribution.'
<i>Anabaena oscillaroides</i>	'Of worldwide distribution in fresh and salt waters.'
<i>Anacystis aeruginosa</i>	'Cosmopolitan in shallow marine or brackish water in protected places.'
<i>A. marina</i>	'Widely distributed as plankton in fresh, brackish and, sometimes, marine waters.'
<i>A. montana</i>	'Of worldwide distribution in freshwater and also in brackish water habitats.'
<i>Microcystis viridis</i>	'Wide spread in fresh to brackish, temperate and tropical waters.'**
<i>Oscillatoria lutea</i>	'Widely distributed in salt and freshwater ... in temperate and tropical regions ... marine records along both coasts of North America ... Of worldwide distribution.'
<i>Spirulina subsala</i>	'Common in shallow sea water along both coasts of North America and widely distributed in freshwater. Of worldwide distribution.'

* Humm and Wicks, 1980

**Freymy, 1972

TABLE 17

POTENTIAL IMPACT OF SELECTED CYANOPHYTES

<u>Species</u>	<u>Occurrence in Ship Sample</u>	<u>Significance*</u>
<i>Anabaena</i> spp.	6, 19, 46	E, SP, T, XF**
<i>Anacystis montana</i>	32	A, PF
<i>Chroococcus</i> spp.	18, 46	E, I, SP, S
<i>Coelosphaerium kuetzingianum</i>	49, 50	A, XF**
<i>Coelosphaerium</i> sp.	18	E, SP
<i>Lyngba</i> spp.	18, 50	E, SP, XF**, XM
<i>Microcystis aeruginosa</i>	18, 19, 40, 46, 49	I, T, XF**
<i>Microcystis</i> sp.	43	E, I, SP, S, XF**
<i>Nodularia</i> sp.	6	XF**
<i>Oscillatoria</i> spp.	6, 9, 18, 31, 46, 49	E, I, SP, S
<i>Spirulina</i> spp.	2, 6, 18, 46	E, SP

*See Biological Significance Key (Table 6)

**Nicholls et.al., 1980

TABLE 18

AQUATIC INVERTEBRATE FAUNA SPECIES LIST

<u>TAXA</u>	<u>OCCURRENCE BY SHIP NUMBER</u>
<u>PROTOZOA</u>	
Unidentified	18
<u>TINTINNIDA</u>	
<i>Cytaprocylis</i> sp.	7, 25, 37, 41
<i>Dictyocysta</i> sp.	7, 37
<i>Dictyocysta elegans</i>	42
<i>Flavella</i> spp.	35, 47
<i>Ptyochocylis</i> sp.	34
<i>Codonella</i> sp.	42
Unidentified	12, 19, 22, 44, 49
<u>ROTIFERA</u>	
<i>Keratella</i> spp.	20, 23, 28, 37, 38, 42, 55
<i>Keratella quadrata</i>	19, 22, 26, 27, 29, 30, 31, 49
Unidentified	16, 18, 49
<u>NEMATODA</u>	
Unidentified	1, 2, 6, 7, 16, 33, 37, 40, 42
<u>MOLLUSCA</u>	
Gastropoda (Veliger Larva)	17, 18, 24, 36
Unidentified Gastropod shell	42
Pelecypoda (immature)	17, 18, 36
<u>ANNELIDA</u>	
<u>Polychaeta</u>	
Family: Spionidae (immature larva)	5, 15, 18, 21
<i>Polydora</i> sp. (larva)	18
<u>Oligochaeta</u>	
Unidentified (Incomplete)	1
Family: Naididae (Incomplete)	18

<u>TAXA</u>	<u>OCCURRENCE BY SHIP NUMBER</u>
<u>TARDIGRADA</u>	
Unidentified	18
<u>ACARINA</u>	
Family: Halacaridae	55
<u>CLADOCERA</u>	
<i>Acroperus</i> sp.	37
<i>Bosmina</i> spp.	8, 16, 17, 19, 22, 28, 29, 30, 38, 40, 45, 55
<i>Bosmina longirostris</i>	2
<i>Evadne</i> sp.	17
<i>Podon</i> spp.	18, 19
Epiphytic eggs	16, 29, 33, 55
<u>OSTRACODA</u>	
Unidentified	8, 9, 11, 15, 18, 22, 24, 25, 30, 39, 40
<u>COPEPODA</u>	
Sub-Order: Calanoida	All except 1, 4, 5, 9, 11, 12, 13, 31, 33, 45, 47, 51
Cyclopoida	11, 17, 18, 19, 25, 36, 38, 53, 54
<i>Corycaeus</i> spp.	8, 37, 41, 42, 44
<i>Corycaeus anglicus</i>	20, 30, 36
Sub-Order: Harpacticoida	2, 19, 22, 27, 32, 33, 35, 37, 52
<i>Euterpina</i> spp.	39, 41, 42
<i>Euterpina acutifrons</i>	25
<i>Parathalestris croni</i>	10
Unidentifiable	19, 31
Nauplii	All except 1, 4, 5, 6, 8, 9, 11, 12, 13, 20, 21, 24, 31, 32, 39, 44, 45, 47, 48, 49, 51, 55
Eggs	2, 17, 18, 19, 22, 23, 35, 42, 43, 44, 54

<u>TAXA</u>	<u>OCCURRENCE BY SHIP NUMBER</u>
<u>CIRRIPEDIA</u>	
<i>Elminius modestus</i> (Nauplii)	8, 10, 15, 16, 17, 23, 24, 25, 48
cypris larvae	23
<i>Verruca</i> spp. (Nauplii)	17, 37
Unidentified (Nauplii)	26
<u>MYSIDACEA</u>	
<i>Neomysis</i> spp.	52, 53, 54
<i>Mesopodopsis slobberei</i>	25
<u>ISOPODA</u>	
<i>Asselus aquaticus</i> ?	37
<i>Idotea baltica</i>	29
Unidentified	12
<u>AMPHIPODA</u>	
<i>Caprella</i> sp.	37
<u>DECAPODA</u>	
Penaeidea (Nauplii)	10
<i>Porcellana</i> sp. (Zoea)	11
<i>Porcellana longicornis</i> (Zoea)	10
<u>DIPTERA</u>	
Family: Chironomidae	
Tribe: Chironomini (adult and larvae)	12, 13, 16, 23, 29
<i>Tanytarsus</i> sp. (adult)	19
Tribe: Orthoclatiini (larvae)	42
<u>CHAETOGNATHA</u>	
<i>Sagitta</i> spp.	25, 36

TABLE 19

TERRESTRIAL INVERTEBRATE FAUNA SPECIES LIST

<u>TAXA</u>	<u>OCCURRENCE BY SHIP NUMBER</u>
<u>COLLEMBOLA</u>	
<i>Isotoma</i> sp.	41
<u>DIPTERA</u>	
Family: Phoridae (adult)	12
<u>HOMOPTERA</u>	
Family: Aphididae (adult)	1
Unidentified (adult)	40
<u>PSOCOPTERA</u>	
Family: Liposcelidae (adult)	5

APPENDIX 1 - SUMMARY OF RESULTS

- POPULATION OF COMMON SPECIES -

1. For 1951 & 1952: The number of organisms per species found in the 1951-52 sample was:

Total No. of Species: 10
Total No. of Organisms: 100
The percentage of the total number of organisms in the 1951-52 sample was:

2. For 1953 & 1954: Sample 1 (1953) & Sample 2 (1954)

3. For 1955 & 1956: The number of organisms of each species found in the 1955-56 sample was:

APPENDIX

4. For 1957 & 1958: The percentage of the total number of organisms in the 1957-58 sample was:

MACROBIOLOGICAL IDENTIFICATION

- EXPLANATION OF COLUMN HEADINGS -

No. Per 100 L Sample: The number of organisms per species found in the 100 L sample examined.

Total No. in Ballast Tank: An estimate of the total number of a species in the ballast tanks of the ship, equal to:

$$\frac{\text{No. Per 100 L Sample} \times \text{Ballast Capacity of Ship(L)}}{100}$$

% Live Organisms: The number of organisms of each species found which were alive, expressed as a percentage of the total number of the species found in 100 L.

% of Population: The percentage representation of each species in the 100 L sample population.

MACROBIOLOGICAL IDENTIFICATION

TABLE A1

SHIP NO: 1

SHIP NAME: Parthenon

BALLAST WATER ORIGIN: Leith, Scotland

BALLAST WATER SALINITY: Polyhaline (2.95%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
No phytoplankton found				
<u>ZOOPLANKTON</u>				
<u>NEMATODA</u>				
Unidentifiable	18	1.0×10^6	100	53
<u>OLIGOCHAETA</u>				
Unidentifiable	6	3.5×10^5	0	17
<u>OTHER ORGANISMS</u>				
<u>DIPTERA</u>				
Unidentifiable (incomplete)	5	2.9×10^5	0	15
<u>HOMOPTERA</u>				
Unidentifiable (incomplete)	5	2.9×10^5	0	15

MACROBIOLOGICAL IDENTIFICATION

TABLE A2

SHIP NO: 2 SHIP NAME: Zabrze Gdynia
 BALLAST WATER ORIGIN: Les Escoumins (St. Lawrence River)
 BALLAST WATER SALINITY: Oligohaline (0.4%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Actinocyclus</i> sp.	18	1.3×10^5	0	4.1
<i>Coscinodiscus</i> sp.	6	4.5×10^4	0	1.4
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium hirundinella</i>	6	4.5×10^4	100	1.4
<u>CHLOROPHYCEAE</u>				
<i>Hyalotheca</i> sp.	18	1.3×10^5	100	4.1
<i>Mougeotia</i> sp.	83	6.2×10^5	100	18.9
<i>Pediastrum duplex</i>	83	6.2×10^5	100	18.9
<i>Pediastrum simplex</i>	53	4.0×10^5	100	12.0
<i>Pediastrum</i> sp.	107	8.0×10^5	100	24.3
Unidentifiable nanofilament (non-branched)	48	3.6×10^5	100	10.9
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Spirulina</i> sp.	6	4.5×10^4	100	1.4
<u>RHODOPHYCEAE (Reds)</u>				
<i>Rhodochorton</i> sp.	6	4.5×10^4	100	1.4
<u>UNIDENTIFIABLE</u>				
Encrustation on <i>Rhodochorton</i> sp. (nannoplankton)	6	4.5×10^4	100	1.4

MACROBIOLOGICAL IDENTIFICATION

TABLE A2 (Cont'd)

SHIP NO: 2

SHIP NAME: Zabrze Gdynia

BALLAST WATER ORIGIN: Les Escoumins (St. Lawrence River)

BALLAST WATER SALINITY: Oligohaline (0.4%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>NEMATODA</u>				
Unidentifiable	6	4.5×10^4	100	28.6
<u>COPEPODA</u>				
S.O. Calanoida	5	3.7×10^4	100	23.8
S.O. Harpacticoida	5	3.7×10^4	100	23.8
<u>CLADOCERA</u>				
<i>Bosmina longirostris</i>	5	3.7×10^4	100	23.8

MACROBIOLOGICAL IDENTIFICATION

TABLE A3

SHIP NO: 3

SHIP NAME: Summer Dreams

BALLAST WATER ORIGIN: Tarragona, Spain

BALLAST WATER SALINITY: Euhaline (3.5%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>UNIDENTIFIED</u>				
Filamentous nanoplankton (non-branched)	6	2.9×10^5	100	100
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	5	2.4×10^5	100	45
<u>UNIDENTIFIABLE</u>				
Nauplius	6	2.9×10^5	100	55

MACROBIOLOGICAL IDENTIFICATION

TABLE A4

SHIP NO: 4

SHIP NAME: Ogden Clipper

BALLAST WATER ORIGIN: Atlantic Coast and Portugal

BALLAST WATER SALINITY: Euhaline (3.4%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
No phytoplankton found				
<u>ZOOPLANKTON</u>				
No zooplankton found				
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Echinoderm larvae?	6	5.9×10^5		

MACROBIOLOGICAL IDENTIFICATION

TABLE A5

SHIP NO: 5

SHIP NAME: Fotini D.E.

BALLAST WATER ORIGIN: Gulf of Mexico

BALLAST WATER SALINITY: Euhaline (3.2%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	24	1.4×10^6	75	66.7
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium</i> sp.	6	3.6×10^5	0	16.7
<u>CYANOPHYCEAE (Blue-Greens)</u>				
Unidentifiable nanofilament (non-branched)	6	3.6×10^5	100	16.7
<u>ZOOPLANKTON</u>				
<u>NEMATODE</u>				
Unidentified	6	3.6×10^5	100	24
<u>POLYCHAETA</u>				
F. Spionidae (immature)	6	3.6×10^5	0	24
<u>OTHER ORGANISMS</u>				
<u>PSOPTERA</u>				
F. Liposcelidae (terrestrial adult)	1	6.0×10^4	0	4
<u>UNIDENTIFIABLE</u>				
Organism #1	6	3.6×10^5	100	24
Organism #2	6	3.6×10^5	100	24

MACROBIOLOGICAL IDENTIFICATION

TABLE A6

SHIP NO: 6

SHIP NAME: Eastern Counte

BALLAST WATER ORIGIN: Philadelphia, Pennsylvania

BALLAST WATER SALINITY: Mesohaline (1.1%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium extensum</i>	6	2.2×10^5	100	3.1
<i>Ceratium tripos</i>	6	2.2×10^5	100	3.1
<i>Ceratium</i> sp.	6	2.2×10^5	0	3.1
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum duplex</i>	24	8.9×10^5	50	12.5
<i>Pediastrum simplex</i>	6	2.2×10^5	0	3.1
<i>Zygnema</i> sp.	48	1.8×10^6	100	25.0
Family: Zygnemataceae	6	2.2×10^5	100	3.1
Family: Desmidiaceae	6	2.2×10^5	100	3.1
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Anabaena</i> sp.	12	4.4×10^5	100	6.3
<i>Anacystis aeruginosa</i>	6	2.2×10^5	100	3.1
<i>Nodularia</i> sp.	18	6.7×10^5	100	9.4
<i>Oscillatoria</i> sp.	24	8.9×10^5	100	12.5
<i>Spirulina</i> sp.	6	2.2×10^5	100	3.1
Unidentifiable nanofilament (non-branched)	6	2.2×10^5	100	3.1
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non-branched)	12	4.4×10^5	100	6.3

MACROBIOLOGICAL IDENTIFICATION

TABLE A6 (Cont'd)

SHIP NO: 6

SHIP NAME: Eastern Counte

BALLAST WATER ORIGIN: Philadelphia, Pennsylvania

BALLAST WATER SALINITY: Mesohaline (1.1%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>NEMATODA</u>				
Unidentified	6	2.2×10^5	100	6.1
<u>COPEPODA</u>				
S.O. Calanoida	68	2.5×10^6	100	69.4
<u>ISOPODA</u>				
Unidentified (incomplete)	6	2.2×10^5	0	6.1
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Echinoderm larvae?	6	2.2×10^5	100	6.1
Fungus	12	4.4×10^5	100	12.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A7

SHIP NO: 7

SHIP NAME: Glafki

BALLAST WATER ORIGIN: Venice, Italy

BALLAST WATER SALINITY: Polyhaline (2.8%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Biddulphia</i> sp.	4	3.9×10^5	100	0.2
<i>Campylodiscus</i> sp.	4	3.9×10^5	100	0.2
<i>Chaetocerus</i> sp.	7	6.8×10^5	100	0.3
<i>Cocconeis placentula</i>	21	2.1×10^6	0	0.9
<i>Coscinodiscus</i> sp.	62	6.1×10^6	29	2.5
<i>Cyclotella</i> sp.	4	3.9×10^5	0	0.2
<i>Dityllum brightwelli</i>	2	2.0×10^5	100	0.1
<i>Fragellaria crotonensis</i>	2	2.0×10^5	0	0.1
<i>Fragellaria</i> sp.	2	2.0×10^5	0	0.1
<i>Gyrodinium</i> sp.	2	2.0×10^5	100	0.1
<i>Hannaea arcus</i>	24	2.4×10^6	0	1.0
<i>Melosira</i> sp. 1	5	4.9×10^5	100	0.2
<i>Melosira</i> sp. 2	2	2.0×10^5	100	0.1
<i>Navicula</i> sp.	7	6.8×10^5	0	0.3
<i>Mitschia</i> sp.	5	4.9×10^5	0	0.2
<i>Rhizosolenia</i> sp.	9	8.8×10^5	44	0.4
<i>Synedra ulna</i>	7	6.8×10^5	0	0.3
<i>Thalassiosira</i> sp.	7	6.8×10^5	100	0.3
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium hirundinella</i>	2	2.0×10^5	100	0.1
<i>Ceratium tripos</i>	5	4.9×10^5	100	0.2
<u>DESMOPHYCEAE (Desmids)</u>				
<i>Procentrum</i> sp.	2	2.0×10^5	0	0.1
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum duplex</i>	2	2.0×10^5	100	0.1
<i>Pediastrum simplex</i>	4	3.9×10^5	100	0.2
<i>Staurastrum</i> sp.	5	4.9×10^5	100	0.2
Unidentifiable nannoplankton (non-branched)	9	8.8×10^5	22	0.4
Unidentifiable nannoplankton (branched)	2	2.0×10^5	100	0.1

MACROBIOLOGICAL IDENTIFICATION

TABLE A7 (Cont'd)

SHIP NO: 7

SHIP NAME: Glafki

BALLAST WATER ORIGIN: Venice, Italy

BALLAST WATER SALINITY: Polyhaline (2.8%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>EUGLENOPHYCEAE (Euglenoids)</u>				
<i>Euglena</i> sp.	560	5.5×10^7	100	23.0
<u>CHRYSTOPHYCEAE (Golden-Browns)</u>				
Unidentifiable flagellate (colourless)	101	9.9×10^6	100	4.1
<u>CRYPTOPHYCEAE (Cryptomonads)</u>				
<i>Cryptomonas</i> sp.	1551	1.5×10^8	100	63.6
<u>CYANOPHYCEAE (Blue-Greens)</u>				
Family: Oscillatoriaceae	4	3.9×10^5	100	0.2
<u>UNIDENTIFIABLE</u>				
Oocystis-like cells (does not fit available keys)	14	1.4×10^6	100	0.6
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
<i>Cyrtocapsa</i> sp.	7	6.8×10^5	0	7.4
<i>Diacyclops</i> sp.	4	3.9×10^5	0	4.2
<u>NEMATODA</u>				
Unidentified	16	1.6×10^6	100	17.0
<u>COPEPODA</u>				
S.O. Calanoida	59	5.8×10^6	35.6	62.8
Nauplii	4	3.9×10^5	100	4.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A7 (Cont'd)

SHIP NO: 7

SHIP NAME: Glafki

BALLAST WATER ORIGIN: Venice, Italy

BALLAST WATER SALINITY: Polyhaline (2.8%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	4	3.9×10^5	0	4.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A8

SHIP NO: 8

SHIP NAME: Derby

BALLAST WATER ORIGIN: Lisbon, Portugal

BALLAST WATER SALINITY: Polyhaline (2.9%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium tripos</i>	6	1.8×10^5	100	50
<u>PHAEOPHYCEAE (Browns)</u>				
Family: Ectocarpaceae	6	1.8×10^5	100	50
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
Unidentifiable Adults	190	5.6×10^6	100	77
S.O. Calanoida	3	8.8×10^4	100	1.2
<i>Corycaeus</i> sp.	2	5.9×10^4	100	0.8
Nauplii	38	1.1×10^6	100	15.4
<u>OSTRACODA</u>				
Unidentifiable	6	1.8×10^5	0	2.4
<u>CLADOCERA</u>				
<i>Bosmina</i> sp.	1	2.9×10^4	100	0.4
<u>BARNACLES</u>				
<i>Elminius modestus</i> (Nauplius)	1	2.9×10^4	100	0.4
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	6	1.8×10^5	100	2.4

MACROBIOLOGICAL IDENTIFICATION

TABLE A9

SHIP NO: 9

SHIP NAME: Murmen

BALLAST WATER ORIGIN: Santiago, Cuba

BALLAST WATER SALINITY: Polyhaline (2.1%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Binucleria</i> sp.	36		100	8.1
<i>Geminella</i> sp.	6		100	1.4
<i>Pediastrum boryanum</i>	12		100	2.7
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Oscillatoria</i> sp.	6		100	1.4
<u>XANTHOPHYCEAE (Yellow-Greens)</u>				
<i>Tribonema</i> sp.	356		85	79.8
<u>UNIDENTIFIABLE</u>				
Encrusted filament (non-branched)	24		100	5.4
Filamentous nannoplankton (non-branched)	6		0	1.4
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
Unidentified (incomplete)	12		0	38.7
<u>OSTRACOD</u>				
Unidentified (empty shell)	6		0	19.4
<u>OTHER ORGANISMS</u>				
<u>DIPTERA</u>				
Unidentified (incomplete adult)	1		0	3.2
Unidentified Organism	12		0	38.7

MACROBIOLOGICAL IDENTIFICATION

TABLE A9 (Cont'd)

SHIP NO: 9

SHIP NAME: Murmen

BALLAST WATER ORIGIN: Santiago, Cuba

BALLAST WATER SALINITY: Polyhaline (2.1%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PORIFERA</u>				
Spicules	-		-	-

MACROBIOLOGICAL IDENTIFICATION

TABLE A10

SHIP NO: 10

SHIP NAME: Mina

BALLAST WATER ORIGIN: Irish Sea

BALLAST WATER SALINITY: Euhaline (3.1%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	12	1.2×10^6	0	20
Disrupted filament (non-branched)	6	5.8×10^5	100	10
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium fusus</i>	18	1.7×10^6	100	30
<i>Ceratium lineatum</i>	18	1.7×10^6	0	30
<i>Ceratium tripos</i>	6	5.8×10^5	0	10
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	348	3.3×10^7	100	81.3
<i>Parathalestris croni</i>	1	9.6×10^4	100	0.2
Nauplii	59	5.7×10^6	100	13.8
<u>BARNACLES</u>				
<i>Elminius modestus</i> (Nauplii)	6	5.8×10^5	100	1.4
<u>DECAPODA</u>				
<i>Porcellana longicornis</i> (Zoea)	2	1.9×10^5	100	0.5
<i>S. Penaeidea</i> (Nauplii)	12	1.2×10^6	100	2.8

MACROBIOLOGICAL IDENTIFICATION

TABLE A11

SHIP NO: 11

SHIP NAME: Mount Pleasant

BALLAST WATER ORIGIN: Norfolk, Virginia

BALLAST WATER SALINITY: Polyhaline (2.0%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium tripos</i>	6	2.8×10^5	0	50
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum duplex</i>	6	2.8×10^5	0	50
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	17	8.0×10^5	94	57.1
S.O. Cyclopoida	9	4.2×10^5	100	32.1
<u>OSTRACODA</u>				
S.C. Ostracoda (unidentifiable)	2	9.4×10^4	100	7.1
<u>DECAPODA</u>				
<i>Porcellana</i> sp. (Zoea)	1	4.7×10^4	100	3.6

MACROBIOLOGICAL IDENTIFICATION

TABLE A12

SHIP NO: 12

SHIP NAME: Lake Aniara

BALLAST WATER ORIGIN: La Romana, Dominican Republic

BALLAST WATER SALINITY: Euhaline (3.2%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Asterionella</i> sp.	6	3.6×10^4	0	50.0
Unidentified pennate diatom	6	3.6×10^4	0	50.0
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
Copepod (incomplete)	6	3.6×10^4	0	17.6
<u>ISOPODA</u>				
Unidentifiable (incomplete)	6	3.6×10^4	0	17.6
<u>OTHER ORGANISMS</u>				
<u>PORIFERA</u>				
Spicules	-	-	-	-
<u>DIPTERA</u>				
F. Phoridae	1	6×10^3	0	2.9
F. Chironomidae				
T. Chironomini (adults)				
(including female with eggs)	3	1.8×10^4	0	8.8
<u>UNIDENTIFIABLE</u>				
Organism #1	12	7.2×10^4	100	35.3
Organism #2	6	3.6×10^4	100	17.6

MACROBIOLOGICAL IDENTIFICATION

TABLE A13

SHIP NO: 13

SHIP NAME: Vishva Pallav

BALLAST WATER ORIGIN: Atlantic Ocean - British Isles

BALLAST WATER SALINITY: Euhaline (3.0%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Gyrodinium</i> sp.	6	2.6×10^5	0	12.5
Unidentified pennate diatom sp.	6	2.6×10^5	0	12.5
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium extensum</i>	12	5.1×10^5	100	25.0
<i>Ceratium lineatum</i>	12	5.1×10^5	100	25.0
<i>Peridinium depressum</i>	6	2.6×10^5	100	12.5
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non-branched)	6	2.6×10^5	100	12.5
<u>ZOOPLANKTON</u>				
No zooplankton found				
<u>OTHER ORGANISMS</u>				
<u>DIPTERA</u>				
F. Chironomidae				
T. Chironomini (adult)	2	8.6×10^4	0	25
<u>UNIDENTIFIABLE</u>				
Echinoderm larvae?	6	2.6×10^5	100	75

MACROBIOLOGICAL IDENTIFICATION

TABLE A14

SHIP NO: 14

SHIP NAME: Federal St. Clair

BALLAST WATER ORIGIN: Saint John, New Brunswick

BALLAST WATER SALINITY: Polyhaline (2.9%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Actinocyclus</i> sp.	6	4.8×10^5	0	11.1
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum simplex</i>	6	4.8×10^5	0	11.1
<i>Ulothrix</i> sp.	18	1.4×10^6	67	33.3
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Cocillatoria lutea</i>	12	9.6×10^5	100	22.2
<u>RHODOPHYCEAE (Reds)</u>				
<i>Rhodocentrum</i> sp.	6	4.8×10^5	100	11.1
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non- branched)	6	4.8×10^5	100	11.1
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	10	8.0×10^5	100	62.5
Nauplii	6	4.8×10^5	100	37.5

MACROBIOLOGICAL IDENTIFICATION

TABLE A15

SHIP NO: 15

SHIP NAME: Rocknes

BALLAST WATER ORIGIN: Caen, France

BALLAST WATER SALINITY: Mesohaline (1.3%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
No phytoplankton found				
<u>ZOOPLANKTON</u>				
<u>POLYCHAETES</u>				
F. Spionidae	17	2.9×10^5	100	10.7
<u>COPEPODA</u>				
S.O. Calanoida	23	3.9×10^5	100	14.5
Nauplii	12	2.0×10^5	100	7.5
<u>OSTRACODA</u>				
S.C. Ostracoda	13	2.2×10^5	100	8.2
<u>BARNACLES</u>				
<i>Eimirus modestus</i> (Nauplii)	82	1.4×10^6	100	51.6
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	6	1.0×10^5	100	3.8
Eggs	6	1.0×10^5	100	3.8

MACROBIOLOGICAL IDENTIFICATION

TABLE A16

SHIP NO: 16

SHIP NAME: Split

BALLAST WATER ORIGIN: Atlantic Coast - Spain

BALLAST WATER SALINITY: Euhaline (3.4%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	12	8.4×10^4	0	1.2
<i>Fragellaria</i> sp.	89	6.2×10^5	50	8.5
<i>Melosira</i> sp. 1	238	1.7×10^6	50	22.8
<i>Melosira</i> sp. 2	535	3.7×10^6	100	51.3
Unidentified pennate diatom	6	4.2×10^4	0	0.6
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium macrocaros</i>	12	8.4×10^4	100	1.2
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum duplex</i>	12	8.4×10^4	100	1.2
<i>Pediastrum simplex</i>	12	8.4×10^4	100	1.2
<i>Staurastrum</i> sp.	12	8.4×10^4	100	1.2
Disrupted filament (non-branched)	48	3.4×10^5	0	4.6
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Spirulina subsala</i>	24	1.7×10^5	100	2.3
<u>UNIDENTIFIABLE</u>				
Filamentous nanoplankton (non-branched) sp. 1	24	1.7×10^5	100	2.3
Filamentous nanoplankton (non-branched) sp. 2	12	8.4×10^4	100	1.15
Disrupted filament (branched)	6	4.2×10^4	0	0.6

MACROBIOLOGICAL IDENTIFICATION

TABLE A16 (Cont'd)

SHIP NO: 16

SHIP NAME: Split

BALLAST WATER ORIGIN: Atlantic Coast - Spain

BALLAST WATER SALINITY: Euhaline (3.4%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
Unidentifiable	12	8.4×10^4	100	16
<u>NEMATODE</u>				
Unidentifiable	6	4.2×10^4	100	8
<u>COPEPODA</u>				
S.O. Calanoida	4	2.8×10^4	100	15.3
Nauplii	7	4.9×10^4	100	9.3
<u>CLADOCERA</u>				
<i>Eosomina</i> sp.	6	4.2×10^4	100	8
Epiphytic eggs	24	1.7×10^5	100	48
<u>BARNACLES</u>				
<i>Eimnionus modestus</i> (Nauplii)	4	2.8×10^4	100	5.3
<u>DIPTERA</u>				
F. Chironomidae	6	4.2×10^4	0	8

MACROBIOLOGICAL IDENTIFICATION

TABLE A17

SHIP NO: 17

SHIP NAME: Untertürkheim Bremen

BALLAST WATER ORIGIN: Mediterranean Sea

BALLAST WATER SALINITY: Mesohaline (0.80%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Gyrodinium aureolum</i>	6	2.7×10^5	0	3.0
<i>Gyrodinium aureolum</i>	131	5.9×10^6	15	64.5
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Phaeodactylum sp.</i>	6	2.7×10^5	100	3.0
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Coelastrum huxleyi</i>	42	1.9×10^6	100	20.7
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non- branched)	12	5.4×10^5	100	5.9
Disrupted filament (non-branched)	6	2.7×10^5	0	3.0
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
Unidentified	6	2.7×10^5	0	3.7
<u>MOLLUSCA</u>				
C. Pelecypoda (immature)	57	2.6×10^6	100	3.5
C. Gastropoda (veliger larva)	1	4.5×10^4	100	0.06
<u>COPEPODA</u>				
S.O. Calanoida	575	2.6×10^7	100	35.3
S.O. Cyclopoida	565	2.5×10^7	100	34.7
S.O. Harpacticoida	1	4.5×10^4	100	0.06
Nauplii	386	1.7×10^7	100	23.7
Eggs	24	1.1×10^6	100	1.5

MACROBIOLOGICAL IDENTIFICATION

TABLE A17 (Cont'd)

SHIP NO: 17

SHIP NAME: Untertürkheim Bremen

BALLAST WATER ORIGIN: Mediterranean Sea

BALLAST WATER SALINITY: Mesohaline (0.80%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>CLADOCERA</u>				
<i>Evadne</i> sp.	3	1.4×10^5	100	0.2
<i>Bosmina</i> sp.	1	4.5×10^4	100	0.06
<u>BARNACLE</u>				
<i>Elminius modestus</i> (Nauplii)	7	3.2×10^5	100	0.4
Unidentified (possible <i>Verruca</i> sp.) - Nauplius	4	1.8×10^5	100	0.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A18

SHIP NO: 18

SHIP NAME: Ocean Glory

BALLAST WATER ORIGIN: Baltimore, Maryland

BALLAST WATER SALINITY: Mesohaline (0.80%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Actinocyclus</i> sp.	6	4.2×10^5	0	0.1
<i>Asterionella</i> sp.	12	8.4×10^5	0	0.2
<i>Coscinodiscus</i> sp.	6	4.2×10^5	0	0.1
<i>Fragellaria</i> sp.	12	8.4×10^5	0	0.2
<i>Nitzschia</i> sp.	6	4.2×10^5	0	0.1
<i>Tabellaria</i> sp.	6	4.2×10^5	0	0.1
Unidentified pennate diatom sp. 1	6	4.2×10^5	0	0.1
Unidentified pennate diatom sp. 2 (Epiphytic on filamentous algae)	36	25.2×10^5	0	0.5
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium furca</i>	24	16.8×10^5	100	0.3
<i>Ceratium longipes</i>	6	4.2×10^5	100	0.1
<i>Ceratium hirundinella</i>	24	16.8×10^5	50	0.3
<i>Ceratium horridum</i>	6	4.2×10^5	0	0.1
Family: Gymnodiaceae	12	8.4×10^5	100	0.2
Family: Peridiniaceae	6	4.2×10^5	100	0.1
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Chlorococcum</i> sp.	6	4.2×10^5	100	0.1
<i>Cladophora</i> sp. 1	18	12.6×10^5	100	0.2
<i>Cladophora</i> sp. 2	6	4.2×10^5	100	0.1
<i>Ctenocladus</i> sp.	12	8.4×10^5	100	0.2
<i>Mougeotia</i> sp.	6	4.2×10^5	100	0.1
<i>Mougeotiopsis calospora</i>	6	4.2×10^5	100	0.1
<i>Pediastrum boryanum</i>	6	4.2×10^5	50	0.1
<i>Pediastrum duplex</i>	12	8.4×10^5	100	0.2
<i>Pediastrum simplex</i>	42	29.4×10^5	29	0.6
<i>Pediastrum</i> sp.	48	33.6×10^5	63	0.6
<i>Pleurodiscus</i> sp.	6	4.2×10^5	100	0.1
<i>Scenedesmus crassus</i>	6	4.2×10^5	100	0.1
<i>Spirogyra</i> sp.	6	4.2×10^5	100	0.1

MACROBIOLOGICAL IDENTIFICATION

TABLE A18 (Cont'd)

SHIP NO: 18

SHIP NAME: Ocean Glory

BALLAST WATER ORIGIN: Baltimore, Maryland

BALLAST WATER SALINITY: Mesohaline (0.80%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<i>Staurastrum sebaldi</i>	12	8.4×10^5	100	0.2
<i>Staurastrum</i> sp.	6	4.2×10^5	100	0.1
<i>Ulothrix</i> sp.	18	12.6×10^5	50	0.2
<i>Zygnema</i> sp.	6	4.2×10^5	100	0.1
Unidentifiable nanofilament (non-branched)	3,214	225×10^7	100	42.2
<u>EUGLENOPHYCEAE (Euglenoids)</u>				
<i>Euglena</i> sp.	6	4.2×10^5	100	0.1
<u>CHRYSTOPHYCEAE (Golden-Browns)</u>				
<i>Botrydiopsis</i> sp.	6	4.2×10^5	100	0.1
<u>CRYPTOMONOPHYCEAE (Cryptomonads)</u>				
<i>Cryptomonas</i> sp.	6	4.2×10^5	100	0.1
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Chroococcus</i> sp.	6	4.2×10^5	100	0.1
<i>Coelosphaerium</i> sp.	6	4.2×10^5	100	0.1
<i>Lyngbya</i> sp.	12	8.4×10^5	100	0.2
<i>Microcystis aeruginosa</i>	6	4.2×10^5	100	0.1
<i>Oscillatoria lutea</i>	36	25.2×10^5	100	0.5
<i>Oscillatoria</i> sp.	42	29.4×10^5	100	0.6
<i>Spirulina</i> sp.	18	12.6×10^5	67	0.2
Family: Oscillatoriaceae	6	4.2×10^5	100	0.1
<u>PHAEOPHYCEAE (Browns)</u>				
<i>Ectocarpus</i> sp.	6	4.2×10^5	100	0.1
<u>UNIDENTIFIABLE</u>				
Filamentous nanoplankton (non-branched)	3,856	270×10^7	100	50.6

MACROBIOLOGICAL IDENTIFICATION

TABLE A18 (Cont'd)

SHIP NO: 18

SHIP NAME: Ocean Glory

BALLAST WATER ORIGIN: Baltimore, Maryland

BALLAST WATER SALINITY: Mesohaline (0.80%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>PROTOZOA</u>				
Unidentified	6	4.2×10^5	100	1.4
<u>ROTIFERA</u>				
<i>Keratella quadrata</i>	89	6.2×10^6	53	21.0
<u>MOLLUSCA</u>				
C. Gastropoda (Veliger larva)	1	7.0×10^4	100	0.2
C. Pelecypoda (immature)	2	1.4×10^5	100	0.5
<u>POLYCHAETA</u>				
F. Spionidae (immature)	26	1.8×10^6	100	6.1
<i>Polydora</i> sp. (larva)	1	7.0×10^4	100	0.2
<u>OLIGOCHAETA</u>				
F. Naididae	1	7.0×10^4	100	0.2
<u>TARDIGRADA</u>				
Unidentified	6	4.2×10^5	0	1.4
<u>CLADOCERA</u>				
<i>Podon</i> sp.	1	7.0×10^4	0	0.2
<u>OSTRACODA</u>				
Unidentified	1	7.0×10^4	0	0.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A18 (Cont'd)

SHIP NO: 18

SHIP NAME: Ocean Glory

BALLAST WATER ORIGIN: Baltimore, Maryland

BALLAST WATER SALINITY: Mesohaline (0.80%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>COPEPODA</u>				
S.O. Calanoida	127	8.9×10^6	100	30.0
S.O. Cyclopoida	55	3.8×10^6	100	13.0
Nauplii	59	4.1×10^6	100	13.9
Eggs	42	2.9×10^6	100	9.9
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	6	4.2×10^5	100	1.4

MACROBIOLOGICAL IDENTIFICATION

TABLE A19

SHIP NO: 19

SHIP NAME: Kapodistrias

BALLAST WATER ORIGIN: Trois Rivières, Quebec

BALLAST WATER SALINITY: Mesohaline (0.85%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	18	2.2×10^6	100	3.7
<i>Hydrosera</i> sp.	6	7.2×10^5	100	1.2
<i>Melosira</i> sp.	12	1.4×10^6	100	2.5
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Peridiniopsis</i> sp.	6	7.2×10^5	0	1.2
Family: Peridiniaceae	6	7.2×10^5	100	1.2
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Chaetonemopsis</i> sp.	6	7.2×10^5	100	1.2
<i>Oosteriopsis longissima</i>	6	7.2×10^5	100	1.2
<i>Pediastrum boryanum</i>	12	1.4×10^6	100	2.5
<i>Pediastrum duplex</i>	12	1.4×10^6	100	2.5
<i>Pediastrum simplex</i>	12	1.4×10^6	100	2.5
<i>Pediastrum</i> sp.	6	7.2×10^5	100	1.2
<i>Shizomeris leibleinii</i>	6	7.2×10^5	100	1.2
<i>Ulothrix</i> sp.	12	1.4×10^6	0	2.5
Family: Chaetonemaceae	6	7.2×10^5	100	1.2
Unidentifiable nanofilaments (non-branched)	83	1.0×10^7	100	17.2
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Anabaena</i> sp.	6	7.2×10^5	100	1.2
<i>Microcystis aeruginosa</i>	12	1.4×10^6	100	2.5
<i>Sprulina subsala</i>	18	2.2×10^6	100	3.7
<u>UNIDENTIFIABLE</u>				
Disrupted filament (non-branched)	12	1.4×10^6	0	2.5
Disrupted filament (branched)	6	7.2×10^5	0	1.2
Filamentous nannoplankton (non- branched)	220	2.6×10^7	100	45.5

MACROBIOLOGICAL IDENTIFICATION

TABLE A19 (Cont'd)

SHIP NO: 19

SHIP NAME: Kapodistrias

BALLAST WATER ORIGIN: Trois Rivières, Quebec

BALLAST WATER SALINITY: Mesohaline (0.85%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
Tintinnid (unidentified)	6	7.2×10^5	0	0.9
<u>ROTIFERA</u>				
<i>Keratella quadrata</i>	12	1.4×10^6	100	1.8
<u>COPEPODA</u>				
S.O. Calanoida	13	1.6×10^6	100	1.9
S.O. Cyclopoida	5	6.0×10^5	100	0.7
Nauplii	12	1.4×10^6	100	1.8
Eggs	6	7.2×10^5	100	0.9
S.O. Harpacticoida	6	7.2×10^5	100	0.9
<u>CLADOCERA</u>				
<i>Podon sp.</i>	1	1.2×10^5	100	0.1
<u>DIPTERA</u>				
<i>Tanytarsus sp.</i>	1	1.2×10^5	0	0.1
<u>OTHER ORGANISMS</u>				
<u>PORIFERA</u>				
Spicules	-		-	-
<u>UNIDENTIFIABLE</u>				
Fungi	600	7.2×10^7	100	89.8
Egg shells	6	7.2×10^5	-	0.9

MACROBIOLOGICAL IDENTIFICATION

TABLE A20

SHIP NO: 20

SHIP NAME: Common Venture

BALLAST WATER ORIGIN: Immingham, England and Atlantic Ocean

BALLAST WATER SALINITY: Euhaline (3.15%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum simplex</i>	6	5.8×10^5	0	33.3
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Spirulina subsala</i>	6	5.8×10^5	100	33.3
<u>UNIDENTIFIABLE</u>				
Disrupted filament (branched)	6	5.8×10^5	0	33.3
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella sp.</i>	12	1.2×10^6	100	5.6
<u>COPEPODA</u>				
<i>Corycaeus anglicus</i>	11	1.1×10^6	100	5.2
S.O. Calanoida	154	1.5×10^7	100	72.3
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Eggs	36	3.5×10^6	100	16.9

MACROBIOLOGICAL IDENTIFICATION

TABLE A21

SHIP NO: 21

SHIP NAME: Spanterza

BALLAST WATER ORIGIN: Adriatic Sea near Ravenna, Italy

BALLAST WATER SALINITY: Polyhaline (3.0%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium longipes</i>	6	4.9×10^5	100	25.0
<i>Ceratium tripos</i>	6	4.9×10^5	0	25.0
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Spirulina subsala</i>	6	4.9×10^5	100	25.0
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non-branched)	6	4.9×10^5	100	25.0
<u>ZOOPLANKTON</u>				
<u>POLYCHAETA</u>				
F. Spionidae (immature larva)	1	8.2×10^4	100	4.3
<u>COPEPODA</u>				
S.O. Calanoida	10	8.2×10^5	100	43.5
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Echinoderm larvae?	12	9.9×10^5	100	52.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A22

SHIP NO: 22

SHIP NAME: Alkaios

BALLAST WATER ORIGIN: Caribbean Sea (near Cuba)

BALLAST WATER SALINITY: Polyhaline (2.5%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Chaetoceros</i> sp.	160	9.6×10^6	100	11.2
<i>Coscinodiscus</i> sp.	107	6.4×10^6	0	7.5
<i>Fragellaria</i> sp.	6	3.6×10^5	100	< 0.1
<i>Melosira</i> sp.	12	7.2×10^5	0	< 0.1
<i>Stephanodiscus</i> sp.	6	3.6×10^5	0	< 0.1
<i>Thallasiosira</i> sp.	77	4.6×10^6	39	5.4
Unidentified pennate diatom	6	3.6×10^7	0	< 0.1
Family: Chaetoceraceae sp. 1	184	1.1×10^7	0	12.9
Family: Chaetoceraceae sp. 2	172	1.0×10^7	0	12.1
Family: Chaetoceraceae sp. 3	166	1.0×10^7	58	11.6
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium longipes</i>	42	2.5×10^6	100	3.0
<i>Ceratium</i> sp.	6	3.6×10^5	0	< 0.1
Family: Gonyaulacaceae	6	3.6×10^5	0	< 0.1
Family: Peridiniaceae sp. 1	6	3.6×10^5	0	< 0.1
Family: Peridiniaceae sp. 2	6	3.6×10^5	0	< 0.1
<u>CHRYSTOPHYCEAE (Gold-Browns)</u>				
Unidentifiable flagellate (colourless)	374	2.2×10^7	100	26.2
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton sp. 1 (non-branched)	48	2.9×10^6	100	3.4
Filamentous nannoplankton sp. 2 (non-branched)	42	2.5×10^6	100	3.0

MACROBIOLOGICAL IDENTIFICATION

TABLE A22 (Cont'd)

SHIP NO: 22

SHIP NAME: Alkaïos

BALLAST WATER ORIGIN: Caribbean Sea (near Cuba)

BALLAST WATER SALINITY: Polyhaline (2.5%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella quadricornata</i>	6		100	1.2
<u>TINTINNIDA</u>				
Unidentified	174		86.2	33.6
<u>COPEPODA</u>				
S.O. Calanoida	137		100	26.4
S.O. Harpacticoida	1		100	0.2
Nauplii	151		100	29.2
Eggs	36		100	6.9
<u>OSTRACODA</u>				
Unidentified	7		0	1.4
<u>CLADOCERA</u>				
<i>Bosmina</i> sp.	6		100	1.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A23

SHIP NO: 23

SHIP NAME: Euro Princess

BALLAST WATER ORIGIN: Birkenhead, England

BALLAST WATER SALINITY: Polyhaline (2.5%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Chaetoceros</i> sp.	18	1.4×10^6	0	27.3
<i>Coscinodiscus</i> sp.	30	2.3×10^6	0	45.5
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium tripos</i>	6	4.5×10^5	100	9.1
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Oscillatoria lutea</i>	6	4.5×10^5	100	9.1
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non-branched)	6	4.5×10^5	100	9.1
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella</i> sp.	6	4.5×10^5	100	7.1
<u>COPEPODA</u>				
S.O. Calanoida	27	2.0×10^6	100	32.1
Nauplii	12	9.1×10^5	100	14.2
Eggs	6	4.5×10^5	100	7.1
<u>BARNACLES</u>				
<i>Elminius modestus</i> (Nauplii)	20	1.5×10^6	100	23.8
Cypris larvae	12	9.1×10^5	100	14.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A23 (Cont'd)

SHIP NO: 23

SHIP NAME: Euro Princess

BALLAST WATER ORIGIN: Birkenhead, England

BALLAST WATER SALINITY: Polyhaline (2.5%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>OTHER ORGANISMS</u>				
<u>DIPTERA</u>				
F. Chironomidae				
T. Chironomini (adult female)	1	7.6×10^4	0	1.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A24

SHIP NO: 24

SHIP NAME: Neptune Tourmaline

BALLAST WATER ORIGIN: Delfzijl, Holland

BALLAST WATER SALINITY: Mesohaline (1.7%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	30	1.0×10^6	60	50.0
Unidentified pennate diatom	6	2.1×10^5	0	10.0
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Spirogyra</i> sp.	6	2.1×10^5	100	10.0
<i>Ulothrix</i> sp.	6	2.1×10^5	100	10.0
Family: Ulotrichaceae	6	2.1×10^5	0	10.0
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Anabaena oscillarioides</i>	6	2.1×10^5	100	10.0
<u>ZOOPLANKTON</u>				
<u>MOLLUSCA</u>				
C. Gastropoda (veliger larva)	122	4.3×10^6	100	84.7
<u>COPEPODA</u>				
S.O. Calanoida	13	4.6×10^5	100	9.0
<u>OSTRACODA</u>				
Unidentified	2	7.0×10^4	100	1.4
<u>BARNACLES</u>				
<i>Elminius modestus</i> (Nauplius)	1	3.5×10^4	100	0.7
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Eggs	6	2.1×10^5	100	4.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A25

SHIP NO: 25

SHIP NAME: Drava

BALLAST WATER ORIGIN: North Sea

BALLAST WATER SALINITY: Polyhaline (2.0‰)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Actinocyclus</i> sp.	5	5.5×10^5	0	0.1
<i>Biddulphia</i> sp.	385	4.2×10^5	57	8.7
<i>Chaetoceros</i> sp.	5	5.5×10^5	0	0.1
<i>Coscinodiscus</i> sp.	700	7.7×10^6	76	15.9
<i>Cyclotella</i> sp.	10	1.1×10^7	0	0.2
<i>Ditylum brightwelli</i>	95	1.0×10^7	68	2.1
<i>Gomphonema</i> sp.	10	1.1×10^6	0	0.2
<i>Rhizosolenia</i> sp.	5	5.5×10^5	0	0.1
<i>Synedra</i> sp.	5	5.5×10^5	0	0.1
<i>Tabellaria flocculosa</i>	5	5.5×10^6	0	0.1
<i>Thalassiosira</i> sp.	10	1.1×10^6	100	0.2
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium fusus</i>	10	1.1×10^6	0	0.2
<i>Ceratium pentagonum</i>	15	1.6×10^6	0	0.3
<i>Ceratium tripos</i>	10	1.1×10^6	0	0.2
<i>Peridinium</i> sp. 1	95	1.0×10^7	95	2.1
<i>Peridinium</i> sp. 2	45	5.0×10^6	100	1.0
<u>DESMOPHYCEAE (Desmoks)</u>				
<i>Procentrum</i> sp.	15	1.6×10^6	100	0.3
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Ankistrodesmus falcatus</i>	5	5.5×10^5	100	0.1
Unidentifiable nanofilament (non-branched)	40	4.4×10^6	0	0.9
<u>CHRYSOPHYCEAE (Golden-Browns)</u>				
Unidentifiable flagellate (colourless)	2,615	2.9×10^8	100	59.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A25 (Cont'd)

SHIP NO: 25

SHIP NAME: Drava

BALLAST WATER ORIGIN:

North Sea

BALLAST WATER SALINITY:

Polyhaline (2.0%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>CRYPTOPHYCEAE (Cryptomonads)</u>				
<i>Cryptomonas</i> sp.	315	3.5×10^7	100	7.1
<u>CYANOPHYCEAE (Blue-Greens)</u>				
Family: Oscillatoriaceae	15	1.6×10^6	100	0.3
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
<i>Cycarnocyllis</i> sp.	15	1.6×10^6	0	1.7
<u>COPEPODA</u>				
S.O. Calanoida	425	4.7×10^7	100	47.3
S.O. Cyclopoida	275	3.0×10^7	100	30.6
Nauplii	129	1.4×10^7	100	14.3
<i>Eurytemora acutifrons</i>	9	9.9×10^5	100	1.0
<u>OSTRACODA</u>				
Unidentified	1	1.1×10^5	100	0.1
<u>BARNACLES</u>				
<i>Elminius modestus</i> (Nauplius)	1	1.1×10^5	100	0.1
<u>MYSIDACEA</u>				
<i>Mesopodopsis slabberi</i>	1	1.1×10^5	100	0.1
<u>CHAETOGNATHA</u>				
<i>Sagitta</i> sp.	8	8.8×10^5	100	0.9

MACROBIOLOGICAL IDENTIFICATION

TABLE A25 (Cont'd)

SHIP NO: 25

SHIP NAME: Drava

BALLAST WATER ORIGIN: North Sea

BALLAST WATER SALINITY: Polyhaline (2.0%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	35	3.8×10^6	100	3.9
Fungal Spores	5	5.5×10^5	100	0.5

MACROBIOLOGICAL IDENTIFICATION

TABLE A26

SHIP NO: 26

SHIP NAME: Maratha Envoy

BALLAST WATER ORIGIN: North Sea

BALLAST WATER SALINITY: Oligohaline (0.3%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>CHLOROPHYCEAE (Greens)</u>				
Family: Ulotrichaceae	6	9.6×10^4	100	100
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella quadrata</i>	18	2.9×10^5	100	7.2
<u>COPEPODA</u>				
S.O. Calanoida	55	8.0×10^5	100	21.9
Nauplius	160	2.6×10^6	100	63.7
<u>BARNACLES</u>				
Unidentifiable Nauplius	12	1.9×10^5	100	4.8
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Plant Stalks	6	9.6×10^4	100	2.4

MACROBIOLOGICAL IDENTIFICATION

TABLE A27

SHIP NO: 27

SHIP NAME: Lujua

BALLAST WATER ORIGIN: Mediterranean Sea

BALLAST WATER SALINITY: Euhaline (3.2%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
No phytoplankton found				
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella quadrata</i>	6	8.2×10^5	0	25
<u>COPEPODA</u>				
S.O. Calanoida	6	8.2×10^5	100	25
Nauplii	12	1.6×10^6	100	50

MACROBIOLOGICAL IDENTIFICATION

TABLE A28

SHIP NO: 28

SHIP NAME: Forum Grace

BALLAST WATER ORIGIN: Baltic Sea and Gulf of Riga

BALLAST WATER SALINITY: Oligohaline (0.18%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
No phytoplankton found				
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella</i> sp.	16,963	1.3×10^9	100	14.9
Unidentified	630	4.9×10^7	100	0.6
<u>COPEPODA</u>				
S.O. Calanoida	3,174	2.5×10^8	100	2.8
Nauplii	3,570	2.8×10^8	100	3.1
<u>CLADOCERA</u>				
<i>Bosmina</i> sp.	88,440	6.9×10^9	100	77.9
<u>UNIDENTIFIABLE</u>				
Organism #1	714	5.5×10^7	100	0.6

MACROBIOLOGICAL IDENTIFICATION

TABLE A29

SHIP NO: 29

SHIP NAME: Captain Panagos

BALLAST WATER ORIGIN: Atlantic Coast - British Isles

BALLAST WATER SALINITY: Euhaline (3.05%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
No phytoplankton found				
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella quadrata</i>	184	1.3×10^7	100	16.9
<u>COPEPODA</u>				
S.O. Calanoida	14	1.0×10^6	100	1.3
Nauplius	42	3.0×10^6	100	3.8
<u>CLADOCERA</u>				
<i>Bosmina</i> sp.	841	6.0×10^7	100	77.2
Epiphytic egg	6	4.3×10^5	100	0.6
<u>ISOPODA</u>				
<i>Idotea baltica</i> (Immature)	1	7.1×10^4	100	0.09
<u>OTHER ORGANISMS</u>				
<u>DIPTERA</u>				
F. Chironomidae				
T. Chironominae (adult)	1	7.1×10^4	0	0.09

MACROBIOLOGICAL IDENTIFICATION

TABLE A30

SHIP NO: 30

SHIP NAME: Stopt Castle

BALLAST WATER ORIGIN: English Channel

BALLAST WATER SALINITY: Euhaline (3.05%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium fusus</i>	6	2.7×10^5	0	50.0
<u>XANTHOPHYCEAE (Yellow-Greens)</u>				
<i>Tribonema sp.</i>	6	2.7×10^5	0	50.0
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella quadrata</i>	42	1.9×10^6	71.4	20.2
<u>COPEPODA</u>				
<i>Corycaeus anglicus</i>	2	9.0×10^4	100	1.0
S.O. Calanoida	39	1.8×10^6	100	18.8
Nauplius	18	8.1×10^5	100	8.6
<u>CLADOCERA</u>				
<i>Bosmina sp.</i>	105	4.7×10^6	100	50.5
<u>OSTRACODA</u>				
Unidentified	2	9.0×10^4	100	1.0

MACROBIOLOGICAL IDENTIFICATION

TABLE A31

SHIP NO: 31

SHIP NAME: Orion

BALLAST WATER ORIGIN: Leningrad, Russia

BALLAST WATER SALINITY: Fresh (0.0%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Melosira</i> sp.	315		100	30.5
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Ulothrix</i> sp.	398		100	38.5
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Oscillatoria</i> sp.	36		100	3.5
<u>UNIDENTIFIABLE</u>				
Filamentous nanoplankton (non- branched)	285		100	27.6
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella quadrata</i>	12		100	92.3
<u>COPEPODA</u>				
Unidentifiable	1		0	7.7

MACROBIOLOGICAL IDENTIFICATION

TABLE A32

SHIP NO: 32

SHIP NAME: Peter L.

BALLAST WATER ORIGIN: Klaipeda, Russia

BALLAST WATER SALINITY: Oligohaline (0.70%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus sp.</i>	297	2.9×10^8	25	74.6
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum boryanum</i>	6	6.0×10^6	0	1.5
Family: Ulotrichaceae	65	6.4×10^7	100	16.3
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Anacystis montana</i>	30	3.0×10^7	100	7.5
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	5	5.0×10^6	100	41.7
S.O. Harpacticoida	1	9.9×10^5	100	8.3
<u>OTHER ORGANISMS</u>				
<u>PORIFERA</u>				
Spicules	-	-	-	-
<u>UNIDENTIFIABLE</u>				
Echinoderm larvae?	6	6.0×10^6	100	50

MACROBIOLOGICAL IDENTIFICATION

TABLE A33

SHIP NO: 33

SHIP NAME: Mathilde

BALLAST WATER ORIGIN: Barcelona, Spain

BALLAST WATER SALINITY: Euhaline (3.25%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus sp.</i>	6	9.7×10^5	0	50.0
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Spirulina subsala</i>	6	9.7×10^5	100	50.0
<u>ZOOPLANKTON</u>				
<u>NEMATODA</u>				
Unidentified	12	1.9×10^6	100	7.2
<u>COPEPODA</u>				
S.O. Harpacticoida	119	1.9×10^7	100	71.2
Nauplii	24	3.9×10^6	100	14.4
<u>CLADOCERA</u>				
Epiphytic egg	6	9.7×10^5	100	3.6
<u>OTHER ORGANISMS</u>				
<u>PORIFERA</u>				
Spicules	-		-	-
<u>UNIDENTIFIABLE</u>				
Echinoderm larvae?	6	9.7×10^5	100	3.6

MACROBIOLOGICAL IDENTIFICATION

TABLE A34

SHIP NO: 34

SHIP NAME: Federal Danube

BALLAST WATER ORIGIN: Antwerp, Belgium

BALLAST WATER SALINITY: Polyhaline (2.95%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Biddulphia</i> sp.	12	2.0×10^6	0	22.2
<i>Chaetoceros</i> sp.	12	2.0×10^6	0	22.2
<i>Coscinodiscus</i> sp.	18	2.9×10^6	0	33.3
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium</i> sp.	6	9.8×10^5	0	11.1
<u>UNIDENTIFIABLE</u>				
Disrupted filament (non-branched)	6	9.8×10^5	0	11.1
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
<i>Ptychocylis</i> sp.	6	9.8×10^5	0	23.1
<u>COPEPODA</u>				
S.O. Calanoida	8	1.3×10^6	100	30.8
Nauplius	12	2.0×10^6	100	46.1
<u>OTHER ORGANISMS</u>				
<u>PORIFERA</u>				
Spicules	-		-	-

MACROBIOLOGICAL IDENTIFICATION

TABLE A35

SHIP NO: 35

SHIP NAME: Demetrios

BALLAST WATER ORIGIN: Mostagnem, Algeria

BALLAST WATER SALINITY: Polyhaline (3.0%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus sp.</i>	6	3.1×10^5	0	16.7
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium furca</i>	6	3.1×10^5	0	16.7
<i>Ceratium macroceros</i>	6	3.1×10^5	0	16.7
<i>Peridinium sp.</i>	6	3.1×10^5	0	16.7
<u>EUGLENOPHYCEAE (Euglenoids)</u>				
Family: Euglenaceae	6	3.1×10^5	0	16.7
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Spirulina subsala</i>	6	3.1×10^5	100	16.7
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
<i>Flavella sp.</i>	6	3.1×10^5	0	16.7
<u>COPEPODA</u>				
S.O. Calanoida	4	2.1×10^5	100	11.1
Nauplii	6	3.1×10^5	100	16.7
Egg	6	3.1×10^5	100	16.7
S.O. Harpacticoida	2	1.0×10^5	100	5.6

MACROBIOLOGICAL IDENTIFICATION

TABLE A35 (Cont'd)

SHIP NO: 35 SHIP NAME: Demetrios

BALLAST WATER ORIGIN: Mostagnem, Algeria

BALLAST WATER SALINITY: Polyhaline (3.0%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>OTHER ORGANISMS</u>				
<u>PORIFERA</u>				
Spicules	-		-	-
<u>UNIDENTIFIABLE</u>				
Organism #1	12	6.2×10^5	100	33.3

MACROBIOLOGICAL IDENTIFICATION

TABLE A36

SHIP NO: 36

SHIP NAME: Ziemia Opolska

BALLAST WATER ORIGIN: Dunkirk, France and North Sea

BALLAST WATER SALINITY: Euhaline (3.6%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Chaetoceros</i> sp.	112	8.6×10^6	100	2.9
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium fusus</i>	24	1.8×10^6	0	0.6
<i>Ceratium tripos</i>	96	7.4×10^6	17	2.5
<i>Peridinium</i> sp.	176	1.4×10^7	86	4.5
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Elaktothrix</i> sp.	816	6.3×10^7	0	20.8
<u>CHRY SOPHYCEAE (Golden-Browns)</u>				
Unidentifiable flagellate (colourless)	2,440	1.8×10^8	100	62.2
<u>CRYPTOPHYCEAE (Cryptomonads)</u>				
<i>Cryptomonas</i> sp.	352	2.7×10^7	100	9.0
<u>ZOOPLANKTON</u>				
<u>MOLLUSCA</u>				
C. Gastropoda (veliger larva)	1	7.7×10^4	100	0.1
C. Pelecypoda (immature)	5	3.8×10^5	100	0.4
<u>COPEPODA</u>				
S.O. Calanoida	956	6.1×10^7	81.4	68.1
S.O. Cyclopoida	10	1.3×10^7	100	0.7
Nauplii	280	2.2×10^7	100	19.9
<i>Corycaeus anglicus</i>	122	9.4×10^6	100	8.7

MACROBIOLOGICAL IDENTIFICATION

TABLE A36 (Cont'd)

SHIP NO: 36

SHIP NAME: Ziemia Opolska

BALLAST WATER ORIGIN: Dunkirk, France and North Sea

BALLAST WATER SALINITY: Euhaline (3.6%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>CHAETOGNATHA</u>				
<i>Sagitta</i> sp.	6	4.6×10^5	100	0.4
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	16	1.2×10^6	100	1.1
Eggs	8	6.2×10^5	100	0.6

MACROBIOLOGICAL IDENTIFICATION

TABLE A37

SHIP NO: 37

SHIP NAME: Dinara

BALLAST WATER ORIGIN: Adriatic Sea (20 mi. from Yugoslavia)

BALLAST WATER SALINITY: Oligohaline (0.10%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Asterionella formosa</i>	195	2.9×10^7	54	0.9
<i>Campylodiscus</i> sp.	15	2.2×10^6	100	0.1
<i>Chaetoceros</i> sp.	15	2.2×10^7	100	0.1
<i>Cocconeis placentula</i>	150	2.2×10^7	80	0.7
<i>Coscinodiscus</i> sp.	60	9.0×10^6	75	0.3
<i>Cymbella</i> sp.	15	2.2×10^6	0	0.1
<i>Eunotia</i> sp.	15	2.2×10^6	0	0.1
<i>Fragellaria crotonensis</i>	15	2.2×10^6	100	0.1
<i>Fragellaria</i> sp.	15	2.2×10^6	100	0.1
<i>Gomphonema</i> sp.	15	2.2×10^6	0	0.1
<i>Leptocylicus danicus</i>	30	4.5×10^6	100	0.1
<i>Melosira various</i>	15	2.2×10^7	100	0.1
<i>Melosira</i> sp.	225	3.4×10^7	100	1.0
<i>Navicula</i> sp.	15	2.2×10^6	100	0.1
<i>Nitzschia sigmoidea</i>	15	2.2×10^7	100	0.1
<i>Nitzschia</i> sp.	150	2.2×10^7	0	0.7
<i>Rhizosolenia</i> sp.	30	4.5×10^6	100	0.1
<i>Surirella</i> sp.	15	2.2×10^6	0	0.1
<i>Synedra ulna</i>	15	2.2×10^6	0	0.1
<i>Synedra</i> sp.	15	2.2×10^7	0	0.1
<i>Tabellaria fenestrata</i>	540	8.1×10^7	100	2.5
<i>Thalassiosira</i> sp.	225	3.4×10^7	93	1.0
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium tripos</i>	30	4.5×10^7	0	0.1
<i>Peridinium</i> sp.	15	2.2×10^6	100	0.1
<u>DESMOPHYCEAE (Desmoks)</u>				
<i>Phalacroma</i> sp.	15	2.2×10^6	0	0.1
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum simplex</i>	15	2.2×10^6	100	0.1
<i>Staurastrum</i> sp.	15	2.2×10^6	100	0.1
Unidentifiable nanofilament (non-branched)	15	2.2×10^6	100	0.1

MACROBIOLOGICAL IDENTIFICATION

TABLE A37 (Cont'd)

SHIP NO: 37

SHIP NAME: Dinara

BALLAST WATER ORIGIN: Adriatic Sea (20 mi. from Yugoslavia)

BALLAST WATER SALINITY: Oligohaline (0.10%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>CHRYSTOPHYCEAE (Yellow-Greens)</u>				
Unidentifiable flagellate (colourless)	17,445	2.6×10^9	0	79.4
<u>CRYPTOPHYCEAE (Cryptomonads)</u>				
<i>Cryptomonas</i> sp.	1,740	2.6×10^8	0	7.9
<i>Rhodomonas</i> sp.	870	1.3×10^8	0	4.0
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella</i> sp.	15	2.2×10^6	0	6.4
<u>TINTINNIDA</u>				
<i>Cyrtarocydis</i> sp.	30	4.5×10^6	0	12.8
<i>Dictyocysta</i> sp.	15	2.2×10^6	0	6.4
<u>NEMATODA</u>				
Unidentified	30	4.5×10^6	100	12.8
<u>MOLLUSCA</u>				
C. Gastropoda (veliger larvae)	3	4.5×10^5	100	1.3
<u>COPEPODA</u>				
S.O. Calanoida	53	8.0×10^6	100	22.6
Nauplii	15	2.2×10^6	0	6.4
<i>Corycaeus</i> sp.	8	1.2×10^6	100	3.4
S.O. Harpacticoida	8	1.2×10^6	100	3.4

MACROBIOLOGICAL IDENTIFICATION

TABLE A37 (Cont'd)

SHIP NO: 37

SHIP NAME: Dinara

BALLAST WATER ORIGIN: Adriatic Sea (20 mi. from Yugoslavia)

BALLAST WATER SALINITY: Oligohaline (0.10%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>CLADOCERA</u>				
<i>Acroperus</i> sp.	3	4.5×10^5	100	1.3
<u>ISOPODA</u>				
<i>Asselus</i> sp. (probably aquaticus)	8	1.2×10^6	100	3.4
<u>BARNACLES</u>				
<i>Verruca</i> sp. (Nauplii)	3	4.5×10^5	100	1.3
<u>CAPRELLIDEA</u>				
<i>Caprella</i> sp.	8	1.2×10^6	100	3.4
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	3	4.5×10^5	10	1.3
Organism #2	3	4.5×10^5	0	1.3
Eggs	15	2.2×10^6	100	6.4
Ciliate	15	2.2×10^6	100	6.4

MACROBIOLOGICAL IDENTIFICATION

TABLE A38

SHIP NO: 38

SHIP NAME: Netuno

BALLAST WATER ORIGIN: Santos, Brazil

BALLAST WATER SALINITY: Polyhaline (0.10%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Fragellaria</i> sp.	12	1.4×10^5	100	16.7
<i>Melosira</i> sp.	24	2.9×10^5	100	33.3
<i>Thallasiosira</i> sp.	6	7.2×10^4	0	8.3
Family: Chaetocraceae	6	7.2×10^4	0	8.3
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium</i> sp.	6	7.2×10^4	100	8.3
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum duplex</i>	6	7.2×10^4	100	8.3
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Microcystis viridis</i>	6	7.2×10^4	100	8.3
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non-branched)	6	7.2×10^4	0	8.3
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella</i> sp.	6	7.2×10^4	100	2.3
<u>COPEPODA</u>				
S.O. Calanoida	131	1.6×10^6	100	51.2
S.O. Cyclopoida	13	1.6×10^5	100	5.1
Nauplii	36	4.3×10^5	100	14.1

MACROBIOLOGICAL IDENTIFICATION

TABLE A38 (Cont'd)

SHIP NO: 38

SHIP NAME: Netuno

BALLAST WATER ORIGIN: Santos, Brazil

BALLAST WATER SALINITY: Polyhaline (0.10%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>CLADOCERA</u>				
<i>Bosmina</i> sp.	52	6.2×10^5	100	20.3
<u>UNIDENTIFIABLE</u>				
Nauplii	18	2.2×10^5	0	7.0

MACROBIOLOGICAL IDENTIFICATION

TABLE A39

SHIP NO: 39

SHIP NAME: Monte Zapola

BALLAST WATER ORIGIN: Bilbao, Spain

BALLAST WATER SALINITY: Polyhaline (2.75%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	71	8.0×10^6	0	74.7
<i>Fragellaria</i> sp.	12	1.4×10^6	100	12.6
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Staurastrum</i> sp.	6	6.8×10^5	100	6.3
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non-branched)	6	6.8×10^5	100	6.3
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	779	8.8×10^7	100	98.8
<i>Euterpina</i> sp.	1	1.1×10^5	100	0.1
<u>OSTRACODA</u>				
Unidentified	2	2.3×10^5	0	0.3
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Echinoderm larvae?	6	6.8×10^5	100	0.8

MACROBIOLOGICAL IDENTIFICATION

TABLE A40

SHIP NO: 40

SHIP NAME: Agelos Seraphin

BALLAST WATER ORIGIN: Suez Canal near Discharge of Nile River

BALLAST WATER SALINITY: Oligohaline (0.05%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Actinocyclus</i> sp.	30		100	1.3
<i>Coscinodiscus</i> sp.	6		0	0.3
<i>Fragellaria</i> sp.	12		100	0.5
<i>Gyrosigma</i> sp.	12		0	0.5
<i>Melosira</i> sp.	36		100	1.6
<i>Tabellaria</i> sp.	6		100	0.3
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Chaetophora</i> sp.	6		100	0.3
<i>Cladophora</i> sp. 1	12		50	0.5
<i>Cladophora</i> sp. 2	30		100	1.3
<i>Hydrodictyon</i> sp.	6		100	0.3
<i>Mougeotia</i> sp.	6		100	0.3
<i>Pediastrum duplex</i>	24		100	1.1
<i>Pediastrum simplex</i>	83		100	3.7
<i>Pediastrum</i> sp.	53		100	2.4
<i>Staurastrum sebaldi</i>	36		100	1.6
Family: Chlamydomonadaceae	12		100	0.5
Family: Ulotrichaceae	368		100	16.5
Unidentifiable nanofilament (non-branched)	1,408		100	63.1
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Microcystis aeruginosa</i>	24		75	1.1
Family: Nostocaceae	12		100	0.5
<u>UNIDENTIFIABLE</u>				
Spherical unicellular algae (disrupted)	36		0	1.6
Disrupted filament (branched)	12		0	0.5

MACROBIOLOGICAL IDENTIFICATION

TABLE A40 (Cont'd)

SHIP NO: 40

SHIP NAME: Agelos Seraphin

BALLAST WATER ORIGIN: Suez Canal near Discharge of Nile River

BALLAST WATER SALINITY: Oligohaline (0.05%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>NEMATODA</u>				
Unidentified	6		100	10.9
<u>COPEPODA</u>				
S.O. Calanoida	24		100	43.6
Nauplii	2		100	3.6
<u>CLADOCERA</u>				
<i>Bosmina</i> sp.	10		100	18.2
<u>OSTRACODA</u>				
Unidentified	10		100	18.2
<u>OTHER ORGANISMS</u>				
<u>HOMOPTERA</u>				
F. Aphididae (adult)	3		0	5.4

MACROBIOLOGICAL IDENTIFICATION

TABLE A41 -

SHIP NO: 41

SHIP NAME: Kraigher B.

BALLAST WATER ORIGIN: Mediterranean Sea (near Marseille)

BALLAST WATER SALINITY: Euhaline (3.21%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Corethron</i> sp.	13	1.5×10^6	100	0.1
<i>Navicula</i> sp.	13	1.5×10^7	100	0.1
<i>Nitzschia</i> sp.	120	1.4×10^7	0	0.5
<i>Thalassiosira</i> sp.	4	4.5×10^5	0	<0.1
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium fusus</i>	82	9.2×10^6	9	0.4
<i>Ceratium pentagonum</i>	94	1.1×10^7	18	0.4
<i>Ceratium tripos</i>	365	4.1×10^5	0	1.6
<i>Peridinium</i> sp. 1	4	4.5×10^5	0	<0.1
<i>Peridinium</i> sp. 2	4	4.5×10^5	0	<0.1
<i>Peridinium</i> sp. 3	4	4.5×10^5	100	<0.1
<u>CHLOROPHYCEAE (Greens)</u>				
Unidentifiable nannoplankton (non-branched)	4	4.5×10^5	100	<0.1
<u>CHRYSOPHYCEAE (Golden-Browns)</u>				
Unidentifiable flagellate (colourless)	20,004	2.2×10^9	100	85.3
<u>CRYPTOPHYCEAE (Cryptomonads)</u>				
<i>Chroomonas</i> sp.	1,995	2.2×10^8	100	8.5
<i>Cryptomonas</i> sp.	748	8.4×10^7	100	3.2

MACROBIOLOGICAL IDENTIFICATION

TABLE A41: (Cont'd)

SHIP NO: 41

SHIP NAME: Kraigher B.

BALLAST WATER ORIGIN: Mediterranean Sea (near Marseille)

BALLAST WATER SALINITY: Euhaline (3.21%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
<i>Cyrtarocydis</i> sp.	21	2.4×10^6	0	16.0
<u>COPEPODA</u>				
S.O. Calanoida	59	6.6×10^6	100	45.0
Nauplii	47	5.3×10^6	100	35.9
<i>Corycaeus</i> sp.	1	1.1×10^5	100	0.8
<i>Euterpina</i> sp.	2	2.2×10^5	100	1.5
<u>COLLEMBOLA</u>				
<i>Isotoma</i> sp.	1	1.1×10^5	0	0.8

MACROBIOLOGICAL IDENTIFICATION

TABLE A42

SHIP NO: 42

SHIP NAME: Castellblanch

BALLAST WATER ORIGIN: Rotterdam, Holland

BALLAST WATER SALINITY: Polyhaline (2.10%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Actinocyclus</i> sp.	48	6.7×10^6	100	3.7
<i>Belleriochea</i> sp.	6	8.4×10^5	0	0.5
<i>Biddulphia</i> sp. 1	48	6.7×10^6	100	3.7
<i>Biddulphia</i> sp. 2	24	3.3×10^6	100	1.8
<i>Coscinodiscus</i>	915	1.3×10^8	85	70.4
<i>Fragellaria</i> sp.	12	1.7×10^6	100	0.9
<i>Melosira</i> sp.	12	1.7×10^6	100	0.9
<i>Stephanodiscus</i> sp.	12	1.7×10^6	0	0.9
<i>Triceratium</i> sp.	48	6.7×10^6	100	3.7
Unidentified pennate diatom	18	2.5×10^6	0	1.4
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium macroceros</i>	18	2.5×10^6	0	1.4
<i>Peridinium depressum</i>	18	2.5×10^6	100	1.4
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum simplex</i>	12	1.7×10^6	100	0.9
<i>Staurastrum</i> sp.	12	1.7×10^6	0	0.9
<i>Ulothrix</i> sp.	12	1.7×10^6	100	0.9
<u>CYANOPHYCEAE (Blue-greens)</u>				
<i>Agmenellum thermale</i>	18	2.5×10^6	100	1.4
<i>Anacystis aeruginosa</i>	18	2.5×10^6	100	1.4
<i>Anacystis marina</i>	18	2.5×10^6	100	1.4
<i>Spirulina subsala</i>	30	4.2×10^6	100	2.3
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
<i>Dictocystis elegans</i>	18	2.5×10^6	100	1.5
<i>Codonella</i> sp.	48	6.7×10^6	100	4.0

MACROBIOLOGICAL IDENTIFICATION

TABLE A42 (Cont'd)

SHIP NO: 42

SHIP NAME: Castellblanch

BALLAST WATER ORIGIN: Rotterdam, Holland

BALLAST WATER SALINITY: Polyhaline (2.10%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella</i> sp.	18	2.5×10^6	100	1.5
<u>MOLLUSCA</u>				
Unidentified snail shell	48	6.7×10^6	0	4.0
<u>NEMATODA</u>				
Unidentified	371	5.2×10^7	100	30.6
<u>COPEPODA</u>				
S.O. Calanoida	145	2.0×10^7	100	11.9
Nauplii	59	8.2×10^6	100	4.8
<i>Corycaeus</i> sp.	5	7.0×10^5	100	0.4
<i>Euterpina</i> sp.	105	1.5×10^7	100	8.6
Eggs	386	5.4×10^7	100	31.8
Egg cases	457	6.4×10^7	-	-
<u>DIPTERA</u>				
F. Chironomidae				
T. Orthocladini (larva)	5	7.0×10^5	0	0.4
<u>OTHER ORGANISMS</u>				
<u>PORIFERA</u>				
Spicules	-		-	-
<u>UNIDENTIFIABLE</u>				
Organism #1	6	8.4×10^5	0	0.5

MACROBIOLOGICAL IDENTIFICATION

TABLE A43

SHIP NO: 43

SHIP NAME: Euterpe

BALLAST WATER ORIGIN: Caribbean Sea

BALLAST WATER SALINITY: Polyhaline (1.83%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	59	1.6×10^6	0	29.2
<i>Hydrosera</i> sp.	12	3.2×10^5	0	5.9
<i>Melosira</i> sp.	6	1.6×10^5	100	3.0
Unidentified pennate diatom	6	1.6×10^5	0	3.0
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium</i> sp.	6	1.6×10^5	100	3.0
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Mougeotia</i> sp.	12	3.2×10^5	100	5.9
<i>Pediastrum duplex</i>	18	4.8×10^5	100	8.9
<i>Pediastrum simplex</i>	59	1.6×10^6	70	29.2
<i>Pteromonas</i> sp. (lorica)	6	1.6×10^5	0	3.0
<i>Staurastrum</i> sp.	6	1.6×10^5	0	3.0
<u>CYANOPHYCEAE (Blue-greens)</u>				
<i>Microcystis</i> sp.	12	3.2×10^5	100	5.9
<u>UNIDENTIFIABLE</u>				
Disrupted filament (branched)	6	1.6×10^5	0	3.0
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
Unidentified (incomplete)	6	1.6×10^5	0	3.4
S.O. Calanoida	36	9.6×10^5	100	20.7
Eggs	24	6.4×10^5	100	13.8
Nauplii	6	1.6×10^5	100	3.4

MACROBIOLOGICAL IDENTIFICATION

TABLE A43 (Cont'd)

SHIP NO: 43

SHIP NAME: Euterpe

BALLAST WATER ORIGIN: Caribbean Sea

BALLAST WATER SALINITY: Polyhaline (1.83%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Echinoderm larvae?	12	3.2×10^5	100	6.9
Organism #1	48	1.3×10^6	100	27.6
Organism #2	6	1.6×10^5	100	3.4
Plant Material	36	9.6×10^5	100	20.7

MACROBIOLOGICAL IDENTIFICATION

TABLE A44

SHIP NO: 44

SHIP NAME: Sophia C.

BALLAST WATER ORIGIN: Black Sea

BALLAST WATER SALINITY: Polyhaline (1.82%)

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	30	2.8×10^6	40	15.7
Family: Chaetoceraceae	6	5.7×10^5	0	3.1
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium tripos</i>	119	1.1×10^7	100	62.3
Family: Peridiniaceae	6	5.7×10^5	100	3.1
<u>CHLOROPHYCEAE (Greens)</u>				
Unidentifiable nanofilament (non-branched)	12	1.1×10^6	100	6.3
<u>CYANOPHYCEAE (Blue-greens)</u>				
<i>Spirulina subsala</i>	6	5.7×10^5	0	3.1
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non- branched)	12	1.1×10^6	100	6.3
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
Unidentified	6	5.7×10^5	0	12.2
<u>COPEPODA</u>				
S.O. Calanoida	13	1.2×10^6	100	26.5
Eggs	12	1.1×10^6	100	24.5
Nauplii	6	5.7×10^5	100	12.2

MACROBIOLOGICAL IDENTIFICATION INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A44 (Cont'd)

SHIP NO: 44

BALLAST WATER ORIGIN: Black Sea

BALLAST WATER SALINITY: Polyhaline (1.82%)

Members

Engineering Advisors

Addresses

CANADA

D.R. Kimmitt
(819) 997-1508

R. Walden
(819) 997-2529

Wild. Waters/Lands
Environment Canada
Ottawa, Ontario
K1A 0E7

UNITED STATES OF AMERICA

Col. J. Briggs
(612) 725-7501

E. Eaton
(612) 725-7583

US Army Corps of Engineers
St. Paul District
1135 US Post Office & Custom House
St. Paul, Minnesota 55101

SHIP NAME: Sophia C

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Echinoderm larva?	6	5.7×10^5	100	12.2
Organism #2	6	5.7×10^5	100	12.2

INTERNATIONAL RAINY LAKE BOARD OF CONTROL IRLBC

MACROBIOLOGICAL IDENTIFICATION

TABLE A45

SHIP NO: 45

BALLAST WATER ORIGIN: Mediterranean Sea

BALLAST WATER SALINITY: Polyhaline (2.61%)

Members

Engineering Advisors

SHIP NAME: Pandora

CANADA

D.R. Kimmet
(819) 997-1508

R. Walden
(819) 997-2529

Ministry of Lands
Environment Canada
Ottawa, Ontario
K1A 0E7

UNITED STATES OF AMERICA

Col. J. Briggs
(612) 725-7501

E. Eaton
(612) 725-7583

US Army Corps of Engineers
St. Paul District
1135 US Post Office & Custom House
St. Paul, Minnesota 55101

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Chaetoceros</i> sp.	6	2.9×10^5	0	20
<i>Coscinodiscus</i> sp.	12	5.8×10^5	0	40
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non- branched)	12	5.8×10^5	100	40
<u>ZOOPLANKTON</u>				
No zooplankton found				

MACROBIOLOGICAL IDENTIFICATION INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A46

SHIP NO: 46

BALLAST WATER ORIGIN: Trois Rivières, Quebec

BALLAST WATER SALINITY: Fresh (0.0%)

Members	CANADA D.R. Kimmett (819) 997-1508	UNITED STATES OF AMERICA Col. J. Briggs (612) 725-7501
Engineering Advisors	R. Waiden (819) 997-2529	E. Eaton (612) 725-7583
	Environment Canada Ottawa, Ontario K1P 6E7	US Army Corps of Engineers St. Paul District 1136 US Post Office & Custom House St. Paul, Minnesota 55101

SHIP NAME: Federal Sheld

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	18	2.7×10^6	0	2.9
<i>Fragellaria</i> sp.	6	8.9×10^5	100	1.0
<i>Tabellaria</i> sp.	24	3.6×10^6	100	3.9
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium hirundinella</i>	18	2.7×10^6	100	2.9
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Coelastrum cambricum</i>	6	8.9×10^5	100	1.0
<i>Coelastrum microporum</i>	6	8.9×10^5	100	1.0
<i>Microspora</i> sp.	6	8.9×10^5	100	1.0
<i>Mougeotia</i> sp.	24	3.6×10^6	100	3.9
<i>Mougeotiopsis calospora</i>	6	8.9×10^5	100	1.0
<i>Pediastrum boryanum</i>	24	3.6×10^6	100	3.9
<i>Pediastrum duplex</i>	36	5.3×10^7	100	5.9
<i>Pediastrum simplex</i>	178	2.6×10^6	63	29.0
<i>Pediastrum</i> sp.	41	6.1×10^5	85	6.7
<i>Spirogyra</i> sp.	6	8.9×10^5	100	1.0
<i>Staurastrum sebaldi</i>	101	1.5×10^7	100	16.5
<i>Stigeoclonium</i> sp.	18	2.7×10^6	100	2.9
Unidentifiable nannoplankton(non-branched)	12	1.8×10^6	50	2.0
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Anabaena</i> sp.	6	8.9×10^5	100	1.0
<i>Chroococcus</i> sp.	6	8.9×10^5	100	1.0
<i>Microcystis aeruginosa</i>	18	2.7×10^5	67	2.9
<i>Oscillatoria</i> sp.	6	8.9×10^5	100	1.0
<i>Spirulina</i> sp.	12	1.8×10^6	100	2.0
Family: Oscillatoriaceae	12	1.8×10^6	100	2.0

INTERNATIONAL RAINY LAKE BOARD OF CONTROL IRLBC

MACROBIOLOGICAL IDENTIFICATION

TABLE A46 (Cont'd)

SHIP NO: 46

BALLAST WATER ORIGIN: Trois Rivières, Quebec

BALLAST WATER SALINITY: Fresh (0.0%)

Members

Engineering Advisors

CANADA

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R. Walden
(819) 997-2529

Federal Ship
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Ottawa, Ontario
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UNITED STATES OF AMERICA

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E. Easton
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US Army Corps of Engineers
St. Paul District
1135 US Post Office & Custom House
St. Paul, Minnesota 55101

SHIP NAME: Federal Ship

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>UNIDENTIFIABLE</u>				
Disrupted filament (branched)	6	8.9×10^5	0	1.0
Filamentous nannoplankton (non-branched)	6	8.9×10^5	100	1.0
Coelastrum-like colony (does not fit available keys)	6	8.9×10^5	100	1.0
Colacium-like branch (does not fit available keys)	6	8.9×10^5	100	1.0
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
Unidentifiable (incomplete)	6	8.9×10^5	0	25
Nauplius	6	8.9×10^5	100	25
<u>CLADOCERA</u>				
<i>Bosmina sp.</i>	6	8.9×10^5	100	25
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Egg shells	6	8.9×10^5	-	25
Fungus	1,200	1.8×10^8	-	-

INTERNATIONAL RAINY LAKE BOARD OF CONTROL IRLBC

MACROBIOLOGICAL IDENTIFICATION

TABLE A47

SHIP NO: 47

BALLAST WATER ORIGIN: Alexandria, Egypt

BALLAST WATER SALINITY: Euhaline (3.24%)

Members

Engineering Advisors

SHIP NAME: Stinnes Zephyr

CANADA

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US Army Corps of Engineers
St. Paul District
1135 US Post Office & Custom House
St. Paul, Minnesota 55101

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum simplex</i>	6	8.7×10^4	0	0
<u>UNIDENTIFIABLE</u>				
Disrupted filament (branched)	6	8.7×10^4	0	0
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
<i>Flavella sp.</i>	12	1.7×10^5	100	66.6
<u>CLADOCERA</u>				
<i>Bosmina sp.</i>	6	8.7×10^4	100	33.3

MACROBIOLOGICAL IDENTIFICATION

INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A48

SHIP NO: 48

BALLAST WATER ORIGIN: Inkoo, Finland and Baltic Sea

BALLAST WATER SALINITY: Mesohaline (1.37%)

Members

Engineering Advisors

Address

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US Army Corps of Engineers
St. Paul District
1135 US Post Office & Custom House
St. Paul, Minnesota 55101

SHIP NAME: Vasilis

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Actinocyclus</i> sp.	14	1.2×10^6	0	<0.1
<i>Cocconeis placentula</i>	28	2.4×10^6	0	0.1
<i>Coscinodiscus</i> sp.	7,014	6.0×10^8	99	23.7
<i>Fragellaria</i> sp.	14	1.2×10^6	100	<0.1
<i>Melosira</i> sp.	14	1.2×10^6	100	<0.1
<i>Thallasionema</i> sp.	42	3.6×10^6	33	0.1
<i>Thallasiosira</i> sp.	56	4.8×10^6	75	0.2
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Peridinium</i> sp.	448	3.8×10^7	100	1.5
<u>EUGLENOPHYCEAE (Euglenoids)</u>				
<i>Euglena</i> sp.	1,218	1.0×10^8	100	4.1
<u>CHRYSOPHYCEAE (Yellow-Greens)</u>				
Unidentifiable flagellate (colourless)	16,685	1.4×10^9	0	56.4
<u>CRYPTOPHYCEAE (Cryptomonads)</u>				
<i>Chroomonas</i> sp.	2,842	2.4×10^8	100	9.6
<i>Cryptomonas</i> sp.	1,218	1.0×10^8	100	4.1
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	141	1.2×10^7	100	97.2
<u>BARNACLES</u>				
<i>Elminius modestus</i> (Nauplii)	4	3.4×10^5	100	2.8

INTERNATIONAL RAINY LAKE BOARD OF CONTROL IRLBC

MACROBIOLOGICAL IDENTIFICATION

TABLE A49

SHIP NO: 49

BALLAST WATER ORIGIN: St. Lawrence

BALLAST WATER SALINITY: Mesohaline (1.35%)

Members

CANADA

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US Army Corps of Engineers
St. Paul District
1136 US Post Office & Custom House
St. Paul, Minnesota 55101

SHIP NAME: Jesus Menendez

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Asterionella</i> sp.	107	2.4×10^7	100	6.0
<i>Chaetoceros</i> sp.	24	5.4×10^6	0	1.4
<i>Coscinodiscus</i> sp.	65	1.5×10^7	44	3.7
<i>Cyclotella</i> sp.	12	2.7×10^6	0	0.7
<i>Cymbella prostrata</i>	6	1.4×10^6	0	0.3
<i>Fragellaria</i> sp.	30	6.8×10^6	0	1.7
<i>Gyrosigma</i> sp.	6	1.4×10^6	0	0.3
<i>Tabellaria</i> sp. 1	12	2.7×10^6	0	0.7
<i>Tabellaria</i> sp. 2	6	1.4×10^6	0	0.3
<i>Thalassiosira</i> sp.	6	1.4×10^6	0	0.3
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium arcticum</i>	6	1.4×10^6	0	0.3
<i>Ceratium extensum</i>	36	8.1×10^6	100	2.0
<i>Ceratium himundinella</i>	12	2.7×10^7	100	0.7
<i>Ceratium longipes</i>	131	3.0×10^7	100	7.3
<i>Ceratium tripos</i>	214	4.8×10^7	81	12.0
<i>Palmella</i> form	6	1.4×10^6	100	0.3
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Cladophora</i> sp. 1	24	5.4×10^6	100	1.4
<i>Cladophora</i> sp. 2	12	2.7×10^6	100	0.7
<i>Coelastrum microporum</i>	6	1.4×10^6	100	0.3
<i>Mougeotia</i> sp.	42	9.5×10^6	60	2.4
<i>Mougeotiopsis calosposa</i>	6	1.4×10^6	100	0.3
<i>Pediastrum duplex</i>	12	2.7×10^7	100	0.7
<i>Pediastrum simplex</i>	166	3.7×10^7	75	9.3
<i>Staurastrum sebaldi</i>	125	2.8×10^6	100	7.0
<i>Stigeoclonium</i> sp.	12	2.7×10^7	100	0.7
Family: Ultrichaceae	59	1.3×10^7	100	3.3

MACROBIOLOGICAL IDENTIFICATION

INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A49 (Cont'd)

SHIP NO: 49

BALLAST WATER ORIGIN: St. Lawrence

BALLAST WATER SALINITY: Mesohaline (1.35%)

Members

Engineering Advisors

SHIP NAME: Jesus Menendez

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US Army Corps of Engineers
St. Paul District
1135 US Post Office & Custom House
St. Paul, Minnesota 55101

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>XANTHOPHYCEAE (Yellow-Greens)</u>				
<i>Tribonema bombycinum</i>	6	1.4×10^6	100	0.3
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Anacystis marina</i>	12	2.7×10^6	100	0.7
<i>Aphanocapsa rivularis</i>	12	2.7×10^6	100	0.7
<i>Coelosphaerium kuetzingianum</i>	6	1.4×10^6	100	0.3
<i>Coelosphaerium naegelianum</i>	6	1.4×10^6	100	0.3
<i>Microcystis aeruginosa</i>	30	6.8×10^6	100	1.7
<i>Oscillatoria</i> sp.	6	1.4×10^6	100	0.3
Unidentifiable nanofilament (non-branched)	6	1.4×10^6	100	0.3
<u>RHODOPHYCEAE (Reds)</u>				
<i>Rhodochorton</i> sp.	6	1.4×10^6	100	0.3
<u>UNIDENTIFIABLE</u>				
Filamentous nanoplankton (non-branched)	309	7.0×10^7	100	17.3
Colourless parasitic algae	244	5.5×10^7	0	13.7
<u>ZOOPLANKTON</u>				
<u>TINTINNIDA</u>				
Unidentified	6	1.4×10^6	0	0.7
<u>ROTIFERA</u>				
<i>Keratella quadrata</i>	6	1.4×10^6	0	0.7
Unidentifiable	6	1.4×10^6	0	0.7

INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

MACROBIOLOGICAL IDENTIFICATION

TABLE A49 (Cont'd)

SHIP NO: 49

BALLAST WATER ORIGIN: St. Lawrence

BALLAST WATER SALINITY: Mesohaline (1.35%)

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St. Paul District
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St. Paul, Minnesota 55101

SHIP NAME: Jesus Menendez

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>COPEPODA</u>				
S.O. Calanoida	53	1.2×10^7	100	6.4
Nauplii	6	1.4×10^6	100	0.7
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	6	1.4×10^6	0	0.7
Casings	6	1.7×10^8	-	0.7
Eggs	737	1.4×10^6	78	89.2

MACROBIOLOGICAL IDENTIFICATION

INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A50

SHIP NO: 50

BALLAST WATER ORIGIN:

Saint John, New Brunswick

BALLAST WATER SALINITY: Mesohaline (0.88%)

Members

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St. Paul, Minnesota 55101

SHIP NAME: Jiquan

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Biddulphia</i> sp.	6	2.4×10^5	0	0.3
<i>Coscinodiscus</i> sp.	2,067	8.3×10^5	87	93.2
<i>Diatomella</i> sp.	6	2.4×10^5	0	0.3
<i>Melosira</i> sp.	12	4.8×10^5	100	0.5
<i>Navicula</i> sp.	6	2.4×10^5	0	0.3
Unidentifiable pennate diatom	18	7.2×10^5	0	0.8
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium longipes</i>	6	2.4×10^5	100	0.3
<i>Ceratium tripos</i>	24	1.6×10^5	100	1.1
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Gladophora</i> sp.	6	2.4×10^5	100	0.3
<i>Microthamnion strictissimum</i>	6	2.4×10^5	100	0.3
<i>Mougeotia</i> sp.	6	2.4×10^5	100	0.3
<i>Pediastrum simplex</i>	6	2.4×10^5	100	0.3
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Coelosphaerium kuetzingianum</i>	6	2.4×10^5	100	0.3
<i>Lyngba</i> sp.	6	2.4×10^5	100	0.3
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non-branched)	36	1.4×10^6	100	1.6

INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A50 (Cont'd)

SHIP NO: 50

BALLAST WATER ORIGIN:

Saint John, New Brunswick

BALLAST WATER SALINITY:

Mesohaline (0.88%)

Members

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Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	334	1.3×10^7	100	77.8
Nauplii	89	3.6×10^6	100	20.7
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	6	2.4×10^5	100	1.4

MACROBIOLOGICAL IDENTIFICATION
INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A51

SHIP NO: 51

BALLAST WATER ORIGIN:

Caribbean Sea (100 mks off coast of Cuba)

BALLAST WATER SALINITY:

Euhaline (3.14%)

SHIP NAME: Kefalonia Wind

CANADA

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US Army Corps of Engineers
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St. Paul, Minnesota 55101

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus sp.</i>	6	5.1×10^5	0	33.3
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium sp.</i>	6	5.1×10^5	0	33.3
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum simplex</i>	6	5.1×10^5	0	33.3
<u>ZOOPLANKTON</u>				
No zooplankton found				
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Echinoderm larvae?	6	5.1×10^5		

MACROBIOLOGICAL IDENTIFICATION
INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A52

SHIP NO: 52

BALLAST WATER ORIGIN: Delfzijl, Holland

BALLAST WATER SALINITY: Mesohaline (1.7%)

Members

Engineering Advisors

Address

CANADA

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US Army Corps of Engineers
St. Paul District
1136 US Post Office & Custom House
St. Paul, Minnesota 55101

SHIP NAME: Euro Princess

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus</i> sp.	6	4.5×10^5	100	6.7
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Cladophora</i> sp.	6	4.5×10^5	0	6.7
<i>Mougeotia</i> sp.	6	4.5×10^5	100	6.7
<i>Ulothrix</i> sp.	6	4.5×10^5	100	6.7
Unidentifiable nanofilament (non- branched)	59	4.5×10^6	100	66.3
<u>UNIDENTIFIABLE</u>				
Filamentous nannoplankton (non- branched)	6	4.5×10^5	100	6.7
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	102	7.7×10^6	100	66.7
Nauplii	42	3.2×10^6	100	27.4
S.O. Harpacticoida	1	7.6×10^4	100	0.6
<u>MYSIDACEA</u>				
<i>Neomysis</i> sp.	2	1.5×10^5	100	1.3
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Eggs	6	4.5×10^5	100	3.9

MACROBIOLOGICAL IDENTIFICATION
INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A53

SHIP NO: 53

BALLAST WATER ORIGIN: Antwerp, Belgium

BALLAST WATER SALINITY: Mesohaline (0.65%)

Members

Engineering Advisors

Addresses

CANADA

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St. Paul District
1135 US Post Office & Custom House
St. Paul, Minnesota 55101

SHIP NAME: Baltic Skov

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Actinocyclus</i> sp.	6	7.9×10^5	0	<0.1
<i>Biddulphia</i> sp.	18	2.4×10^6	67	0.2
<i>Campylodiscus</i> sp.	144	1.9×10^5	0	1.3
<i>Cocconeis placentula</i>	6	7.9×10^7	0	<0.1
<i>Coscinodiscus</i> sp.	84	1.1×10^5	36	0.8
<i>Melosira</i> sp.	6	7.9×10^5	100	<0.1
<i>Navicula</i> sp.	6	7.9×10^5	0	<0.1
<i>Nitzschia</i> sp.	276	3.6×10^7	0	2.5
<i>Thalassiosira</i> sp.	12	1.6×10^6	100	0.1
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Peridinium</i> sp.	6	7.9×10^5	100	<0.1
<u>CHRYSTOPHYCEAE (Yellow-Greens)</u>				
Unidentifiable flagellate (colourless)	10,044	1.3×10^9	100*	91.0
<u>CRYPTOPHYCEAE (Cryptomonads)</u>				
<i>Cryptomonas</i> sp.	420	5.5×10^7	100*	3.8
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	501	6.6×10^7	94	23.9
S.O. Cyclopoida	97	1.3×10^8	100	4.6
Nauplii	1,476	1.9×10^8	100	70.4
<u>MYSIDACEA</u>				
<i>Neomysis</i> sp.	17	2.2×10^6	100	0.8

MACROBIOLOGICAL IDENTIFICATION

INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

TABLE A53 (Cont'd)

SHIP NO: 53

BALLAST WATER ORIGIN: Antwerp, Belgium

BALLAST WATER SALINITY: Mesohaline (0.65%)

Members

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Addresses

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US Army Corps of Engineers
St. Paul District
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St. Paul, Minnesota 55101

SHIP NAME: Baltic Skou

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>OTHER ORGANISMS</u>				
<u>UNIDENTIFIABLE</u>				
Organism #1	6	7.9×10^5	0	0.3

MACROBIOLOGICAL IDENTIFICATION

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TABLE A54

SHIP NO: 54

BALLAST WATER ORIGIN: Adriatic Sea

BALLAST WATER SALINITY: Euhaline (3.13%)

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SHIP NAME: Sirie

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>BACILLARIOPHYCEAE (Diatoms)</u>				
<i>Coscinodiscus sp.</i>	24	2.4×10^6	0	44.4
<i>Triceratium sp.</i>	12	1.2×10^5	0	22.2
Unidentifiable pennate diatom	6	6.0×10^5	0	11.1
<u>DINOPHYCEAE (Dinoflagellates)</u>				
<i>Ceratium tripos</i>	6	6.0×10^5	0	11.1
<u>CHLOROPHYCEAE (Greens)</u>				
<i>Pediastrum simplex</i>	6	6.0×10^5	0	11.1
<u>ZOOPLANKTON</u>				
<u>COPEPODA</u>				
S.O. Calanoida	16	1.6×10^6	100	26.7
S.O. Cyclopoida	15	1.5×10^5	100	25
Eggs	6	6.0×10^5	100	10
Nauplii	18	1.8×10^6	100	30
<u>MYSIDACEA</u>				
<i>Neomysis sp.</i>	5	5.0×10^5	100	8.3

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TABLE A55

SHIP NO: 55

BALLAST WATER ORIGIN:

Atlantic Ocean (200 km from Calais, France)

BALLAST WATER SALINITY:

Euhaline (3.08%)

Members

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SHIP NAME: Marko Marulic

Description	No. Per 100 L Sample	Total No. in Ballast Tank	% Live Organisms	% of Population
<u>PHYTOPLANKTON</u>				
<u>CYANOPHYCEAE (Blue-Greens)</u>				
<i>Anabaena oscillaroides</i>	6	1.5×10^5	100	100
<u>ZOOPLANKTON</u>				
<u>ROTIFERA</u>				
<i>Keratella sp.</i>	6	1.5×10^6	0	10.5
<u>ACARINA</u>				
F. Halacaridae (unidentifiable)	6	1.5×10^6	100	10.5
<u>COPEPODA</u>				
S.O. Calanoida	9	2.2×10^5	100	15.8
<u>CLADOCERA</u>				
<i>Bosmina sp.</i>	30	7.5×10^5	100	52.6
Epiphytic egg	6	1.5×10^6	100	10.5

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TERMS OF REFERENCE

OBJECTIVES

1. To quantify and qualify by current taxonomic methods species of life forms, dead or living in the ballast waters emanating in overseas ports and to identify the nonendemic life forms.
2. To characterize ballast waters with respect to their ability to sustain life forms.

STATEMENT OF WORK

1. In general the work is divided into two parts. The part to be done in Canada (by the Canadian contractor) consists of sample taking and identification of macro-lifeforms. The U.S. will receive samples prepared and forwarded by the Canadian contractor, and analyse them for microbial content.

The Canadian contractor will take appropriate ballast water samples from the ballast tanks of 55 ships arriving from overseas ports. The choice of ships should be such that as wide a selection of ports as possible be included. Ports should be representative of the various major climatic and geographic areas of the world.

In this regard contacts should be made with shipping company associations and ship agencies who are in a position to advise on ports of origin and arrival times. For technical reasons, samples should be collected and sent expeditiously to acceptable laboratories for analysis when the ship is either in the Montreal/Cornwall area or in the Welland Canal/Sault Ste. Marie area.

Sampling procedure is to be as follows:

- (a) In approximately 50% of the cases, water samples should be taken at a suitable take off connection on the discharge side of the ballast (or similar) pump after several tons of ballast water will have been pumped overboard and/or into the engine room bilges. Ship's crews are to operate the necessary pumps and valves.
- (b) In approximately 50% of the cases the aft manhole cover of at least one double bottom tank should be removed for the taking of grab samples of ballast waters and tank side/top encrustations. Costs of removal and replacement of covers to be borne by the contractor.

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- (c) All water and sediment/encrustation samples are to be divided into two lots; one for processing in Canada, the other for shipment to one or more research laboratories in the USA for microscopic examinations by US designated officials. Methods of sample preservation are to be as specified in Standard Methods (14th edition) and transport to USA is to be to the satisfaction of the US authorities. Transport costs are to be paid by the contractor.
- (d) While on the ship, information as detailed by section 3 should be obtained from the ship's various log books, or personnel, if possible.
2. (a) Samples that are to be processed in Canada should be analyzed for lifeforms by visible and microscopic methods.
- (b) Additionally, water and sediment/encrustation samples should be analyzed for certain nutrient concentrations and physical/chemical parameters such as pH, temperature, salinity, dissolved oxygen (determined only at the time when samples are taken) and BOD, (and any others that the contractor feels are relevant and the government of Canada agrees).
3. Based on information gathered in item 2(a) and (b), a report should be prepared and include the following:
- (a) Port (or region) or origin of ballast water. (There may be more than one port involved where ballast was taken on).
- (b) Ship particulars i.e. name, official number or call letters, port of registry, gross tonnage, total ballasting capacity in terms of m³, quantity of ballast carried on voyage in question.
- (c) (i) Particulars of voyage in ballasted condition, e.g. Depart Burgos, Bulgaria on Aug. 14, 1980 with 3600 tonnes ballast, direct to Opporto, Portugal for load of 2,000 tonnes cargo and deballasted #3 double bottoms (800 tonnes) thence direct to the Great Lakes.

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(ii) Seastate and ambient sea water temperatures;
e.g. smooth voyage, sea water temperature for first
12 days between 22°C and 24°C, last 4 days between
10°C and 22°C.

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(d) Identification and enumeration of lifeforms by species, (some macro organisms may be dead but still identifiable and should be identified). Numbers to be extrapolated to reflect total organisms in the ballast water carried. Identify non-endemic species.

(e) Ballast water characteristics at time of sampling.

4. Repeat the sampling work outlined in sections 1-2-3 on 5% of the ships entering the Great Lakes with ballast waters from any of the Gulf of St. Lawrence ports (e.g. Sept Iles, Baie Comeau, Gaspé, etc.) as a control.

5. Assess and identify the magnitude and implications of the problems existing as a result of the findings with respect to their effects or potential effects (if any) on the ecosystem of the Great Lakes.

For the purpose of this contract, the eastern boundary of the Great Lakes will be considered to be the St. Lambert Locks at Montreal.

CA1 EP 59081P02

Canada. EPS. WPCD.

THE PRESENCE AND IMPLICATION OF FOREIGN ORGANISMS IN
SHIP BALLAST WATERS DISCHARGED INTO THE GREAT LAKES.
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